

Foreword by Donald F. Blair—Author of *Arborist Equipment*

KNOTS **at work**

A FIELD GUIDE FOR
THE MODERN ARBORIST

JEFF JEPSON

Illustrations by Bryan Kotwica
and Luke Jepson

KNOTS at work



A FIELD GUIDE FOR THE MODERN ARBORIST

"No one ties knots more frequently and of such variety than those who work in the tree care profession."

"In a profession as potentially dangerous as this, only knots that are correctly tied and aptly applied every time will do. Anything less is likely to lead to a short career."

The reasons given above are why *Knots at Work* was written. With over 50 arborist knots presented, both aspects of knot knowledge are given equal time—knot construction (tying the knots) and knot application (using the knots). This information can be quickly grasped from the lavishly illustrated pages and the easy-to-read text. The unique cross-reference format makes it easy to navigate through the book, and its compact size will encourage its use out in the field where it's needed most.



Jeff Jepson is a certified arborist and he has owned Beaver Tree Service in Longville, Minnesota, since 1989. He has written two important books for the tree care profession, including the best seller, *The Tree Climber's Companion* and *To Fell a Tree*. *Knots at Work* is his third book.

Bryan Kotwica has been illustrating books, magazines, and catalogs for the tree care industry for over 25 years. He has also been a professional tree worker and certified arborist for just as long, which makes him the perfect illustrator for books such as this.

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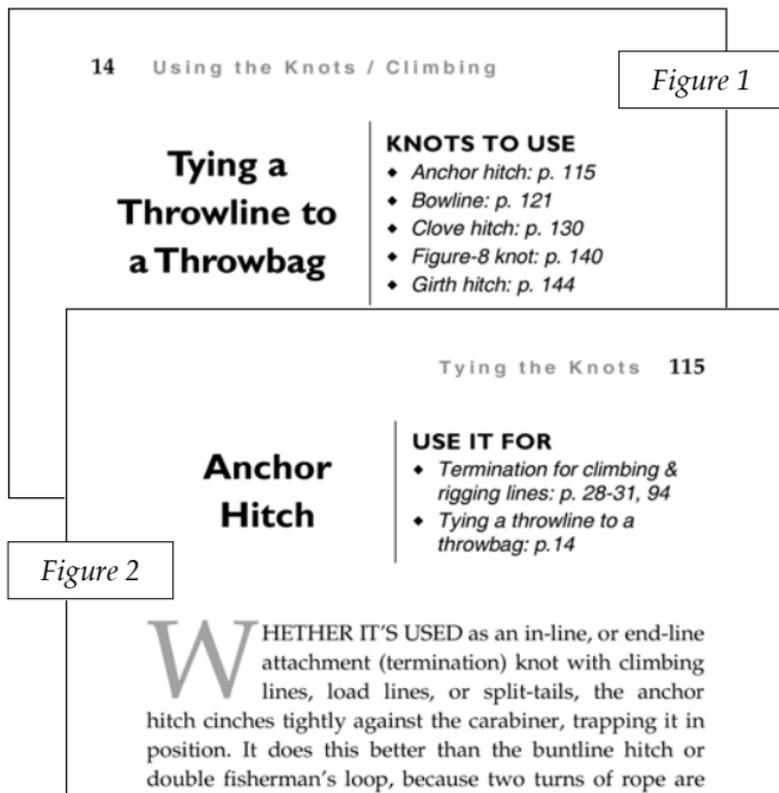
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How to Use This Book

THESE ARE FOUR things you need to know about this book. First, when reading the *Using the Knots* part of the book (parts 1 & 2), notice that the topic heading has two columns (fig. 1). The left column describes a particular use for a knot, while the right column lists the knots best suited for that use. The page numbers following the knot listings in turn direct you to part 3 of the book—*Tying the Knots* (fig. 2). Here, in the left column, you will find the name of the knot you were referred to, and in the right column a list of ways it can be used, along with the page numbers to refer you to those applications. This “cross-reference” feature makes the book 3-dimensional and thus, easy to navigate through its pages.



Grip Knot in the Throwline

KNOTS TO USE

- ◆ *Slip knot: p. 164*
- ◆ *Trigger knot: p. 16*

THROWLINE IS SKINNY and slippery, which makes it hard to grip when making a throw. This problem can be remedied with a simple slip knot tied in the throwline about three feet from the throwbag (about hip height with the bag on the ground). This simple knot will allow you to more effectively grip and release the throwline. The knot is quick to tie and can be

easily pulled out afterward—just step on the bag and pull up on the line above the knot.

An effective variation of the grip knot is what I call the trigger knot. Begin by tying a slip knot, but with a loop large enough (2-3 inches) to accommodate your trigger finger (forefinger). Next, place the part of the line above the knot over your finger as well and pinch down on both parts of the line with your thumb as you make your shot. By keeping the slip knot rather loose, the knot will usually release on its own during mid-shot. Remember, before you throw, alert others that might be in the vicinity by shouting a warning like, “Stand Clear!” or “Throwing!”



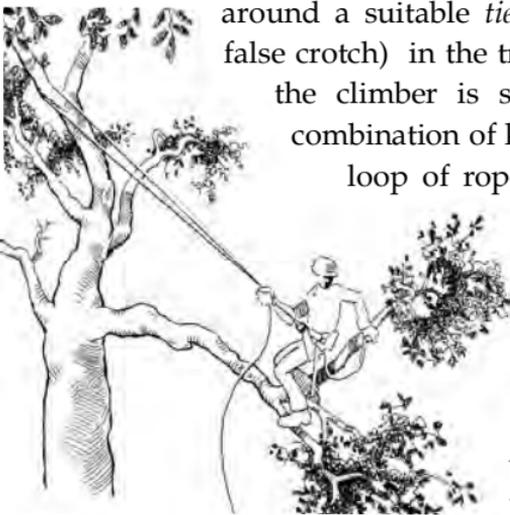
INTRO TO CLIMBING METHODS

Doubled Rope Technique

PERHAPS NO OTHER ASPECT of tree work has received as much attention regarding the use of knots and the development of new ones than that of climbing trees. And the majority of this knot application and innovation has been focused primarily on the *doubled rope technique* (DdRT) since it is the one most commonly used when working in trees.⁴

There are several other effective methods used for tree climbing as well, which will be discussed shortly—the *single rope technique* (SRT) and the *secured footlock technique* (SFT), but the DdRT remains unsurpassed for all-around tree climbing performance. Unlike the SRT and the SFT, which have traditionally been used for ascending purposes only, the DdRT functions as a work-positioning system as well, belaying the climber during all stages of climbing—from ascending the tree and working aloft to descending safely back to the ground.

The DdRT utilizes a *single rope* that is *doubled* around a suitable *tie-in point* (natural or false crotch) in the tree canopy to which the climber is secured by using a combination of knots. The result is a loop of rope which, like a belt around a pulley, moves around the tie-in point as the climber moves and works in the tree. This is the characteristic which makes the DdRT distinctly



Limb walking while using the DdRT.

DdRT distinctly

Stopper Knot in a Climbing Line

KNOTS TO USE

- ◆ *Figure-8 knot: p. 140*
- ◆ *Slip knot: p. 164*

THE OLD ADAGE, “when you reach the end of your rope, tie a knot in it and hang on,” is particularly relevant to the climber who is about to descend from the tree using the DdRT.⁶ In this instance, failing to tie a stopper knot in the end of the climbing line could mean the end of a climbing career. This almost happened at a climbing championship where I witnessed a competitor come within two feet of the end of his line during a descent. It was the yells,

screams, and whistles of the onlookers that got his attention and caused him to stop—still thirty feet above the ground.

It was then he realized what the fuss was all about: he had overlooked tying a stopper knot in the end of his rope. I hate to think what would have happened had he continued with his descent.



Figure-8
stopper knot

Slip knot as
stopper knot

Tying a stopper knot near the end of your climbing line will prevent the rope from pulling through the climbing hitch.

Backing Up a Single Handled Ascender

KNOTS TO USE

- ♦ *Valdôtain tresse*: p. 167 (or other suitable climbing / friction hitch)

HANDLED ASCENDERS are one of the greatest tools ever invented for single rope climbing. But they are not infallible. If the camming mechanism makes contact with leaves, twigs, other tree debris, or even the climber's hands, they can accidentally open and fail to grab the rope.

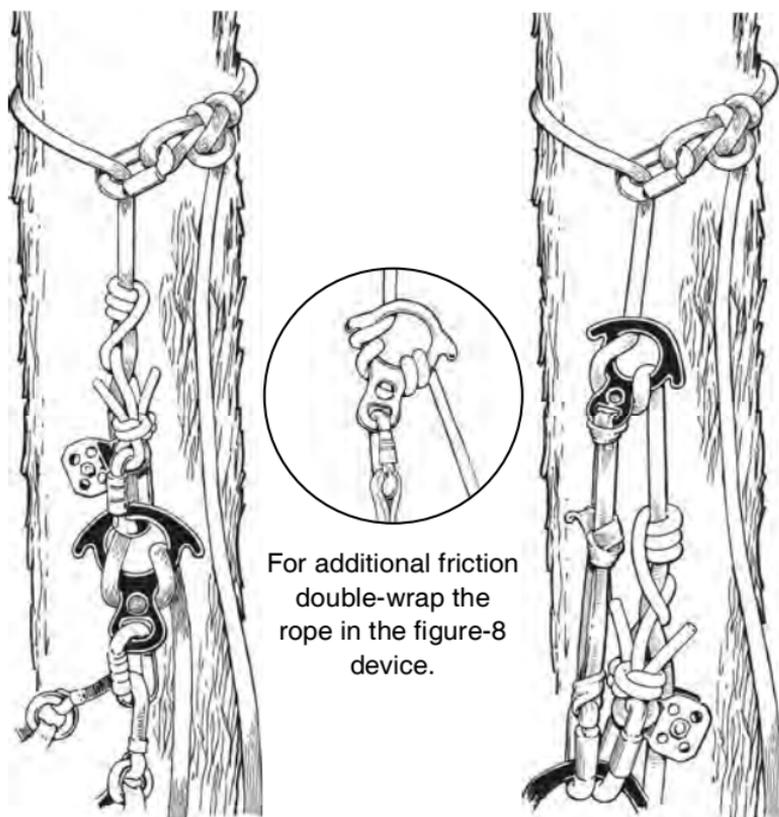
Therefore, if your only means of fall protection is a single ascender, the prudent thing to do is back it up with a second means. Though there are a variety of ways this can be accomplished, I prefer using a climbing, or friction hitch to do the job.

Finding a climbing hitch that can perform this task effectively on a single line is tricky—more so than when backing up a double ascender on a doubled line. With a doubled rope, each leg of the line, and corresponding backup knot, bear only half the climber's weight. Whereas, a backup knot tied to a single line would bear all the climber's weight if the ascender were to fail.

Though the backup hitch may grip the line effectively when initially tied, it will often slip after the climber's weight is applied. If more wraps and braids are added to increase friction, it may then become difficult to advance the hitch with the ascender. I have found that the climbing hitch which most consistently conquers



The VT as a backup knot.



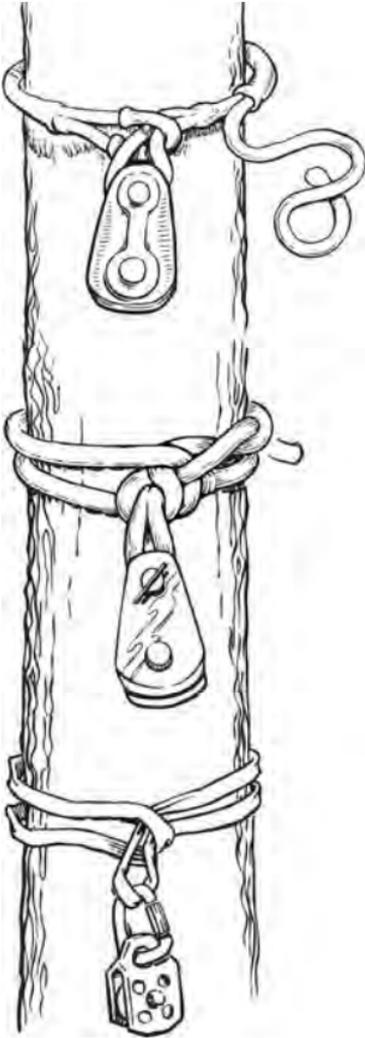
For additional friction
double-wrap the
rope in the figure-8
device.

Low figure-8 method

High figure-8 method

Fifth, the CLL can be choked off on a spar tree from which the climber can descend and yet retrieve it afterward from the ground. This is considered an advanced technique, because of its many elements of assembly, and should only be used by experienced climbers. There are two different ways you can set up the descending system—with the *low figure-8 method* or *high figure-8 method*. With the “low” method, the figure-8 is kept short, or close to the climber’s saddle and *below* the climbing hitch. With the “high” method the figure-8 is kept farther away with the use of a webbing sling (or tether) and positioned *above* the climbing hitch (*see illustrations above*). If a figure-8 device is unavailable, a Munter hitch makes a good substitute (*see pages 40 and 152 for more details*).

The whoopie sling, which is essentially an adjustable endless loop, is secured around a limb or main stem of the tree with a girth hitch. The adjustable feature of this sling allows it to be snugged tightly against the tree, reducing the amount of slack in the system. This is particularly important when the rigging point is below the piece being cut.



Three ways of “slinging” a block or pulley to a stem (from top down):

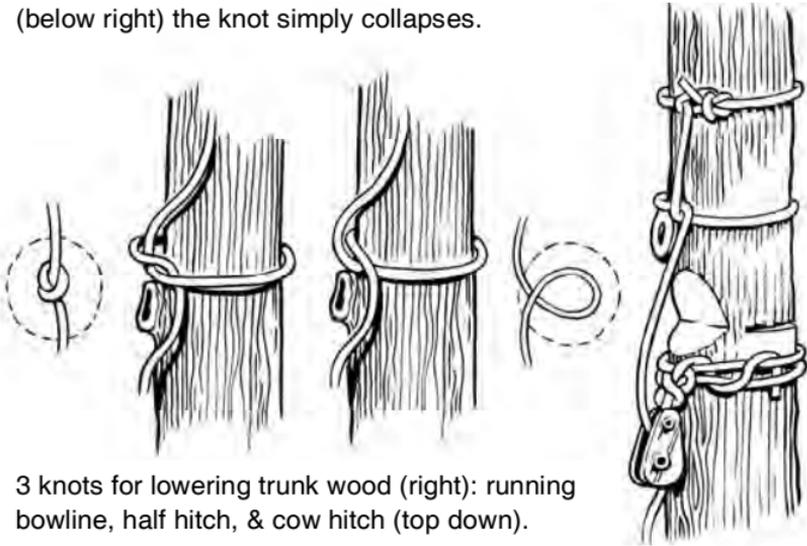
- A. Whoopie sling (girth hitch)
- B. Single-eye sling (cow hitch)
- C. Webbing sling (girth hitch)

particularly important when the rigging point is below the piece being cut.

The single-eye sling is installed using two of the same knots for installing a lowering device to the trunk—the cow and timber hitch. The cow hitch is the one most frequently used higher in the tree, where rigging points consist of smaller diameter wood and the timber hitch for the larger wood encountered lower in the tree.

A webbing sling can be secured in the tree with either a girth hitch or the basket hitch. However, the girth hitch will downgrade sling strength by 1/4 to 1/3, and should only be used when lowering light loads. On the other hand, using the basket hitch will actually double the sling’s strength. Wrapping the sling on the stem before securing the pulley will help keep it in place (see pages 62-63, 116).

A marline hitch (below left) forms an overhand knot if the wood is removed, with a half hitch (below right) the knot simply collapses.



3 knots for lowering trunk wood (right): running bowline, half hitch, & cow hitch (top down).

When possible, tie the half hitch above a branch collar of a limb previously removed (or a swelling or protrusion on the trunk) to keep the knot, and rope, in place.

When to use the marline hitch. In instances where the section of wood being cut is particularly short or slippery, the marline hitch will grip the wood more effectively than a simple half hitch. And when a series of these hitches are tied along the length of a dead or decayed wood piece, they can help hold the piece together. Another benefit of the marline is that once tied it holds fast to the wood piece making it easier to tie the primary knot afterward—just leave enough rope length for doing so.

At first glance the two hitches look very similar, but in fact are quite different. The difference becomes most evident when the hitch is removed from the wood it is attached to. With the marline hitch an overhand knot is formed, but with a half hitch the knot simply collapses. It is the overhand knot feature of the former knot that allows it to grip wood more effectively. For the same reason, however, the marline can only be tied using the end of the line, whereas the half hitch can be tied on a bight.

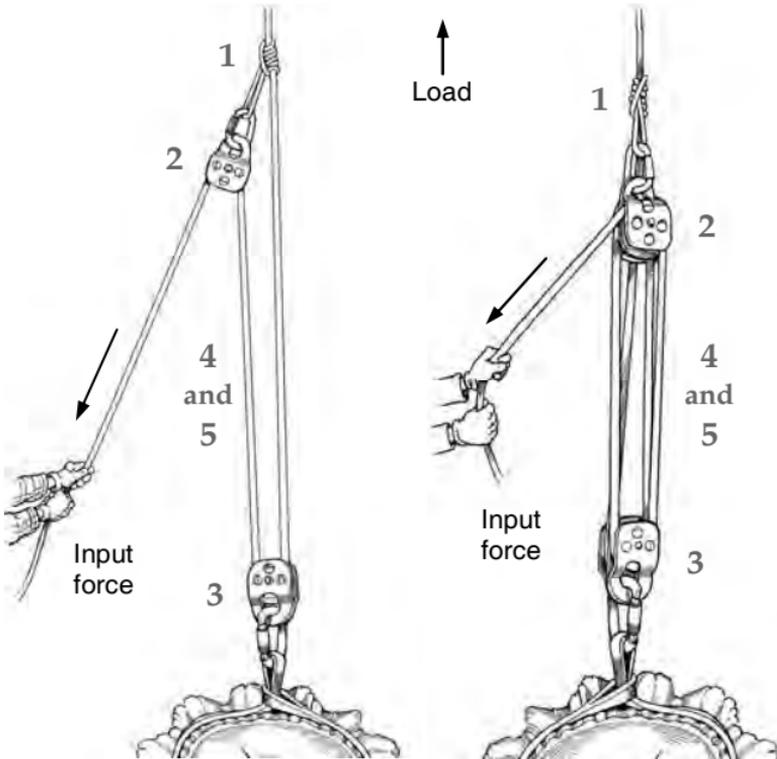
Assembling an MA Pulley System

The process of assembling an MA pulley system to a pull line is essentially the same whether it's a 3:1 or 5:1 system. The only difference is the types of pulleys used (single-block or double-block) and how they are arranged on the line. The pulley that is secured to the pull line itself is called a load, or moving pulley. This pulley provides and determines the amount of MA the pulley system will offer. The pulley secured to the anchor is called an anchor pulley. Its role in the system is to redirect the rope, not to increase the MA. Refer to the illustrations below to assemble either the 3:1 or 5:1 system. The instructions that follow pertain to both MA systems.

Step 1: Attach a sling to the pull line using a friction hitch appropriate to the type of sling being used. A Prusik loop is usually tied on the line with a Prusik hitch,

3:1 MA System

5:1 MA System

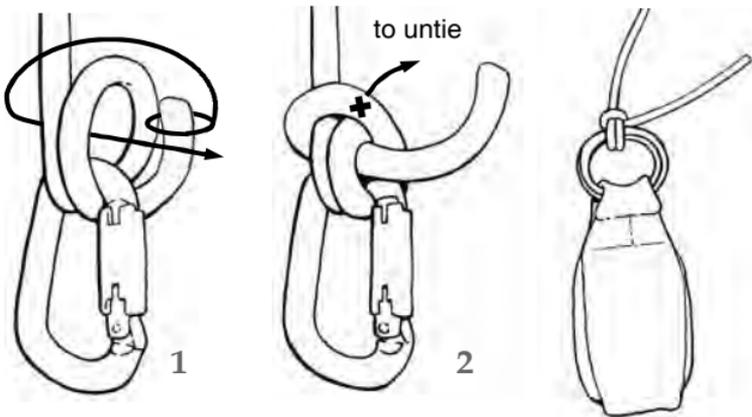


Anchor Hitch

USE IT FOR

- ◆ *Termination for climbing & rigging lines: p. 28-31, 94*
- ◆ *Tying a throwline to a throwbag: p. 14*

WHETHER IT'S USED as an in-line, or end-line attachment (termination) knot with climbing lines, load lines, or split-tails, the anchor hitch cinches tightly against the carabiner, trapping it in position. It does this better than the buntline hitch or double fisherman's loop, because two turns of rope are taken on the carabiner instead of one, which increases the amount of surface area of rope that is available to grip the connector. This configuration also contributes to the ease of untying it, even after it has been heavily loaded. If properly tied and a tail length of at three inches remains, it is not necessary to tie a stopper knot in the tail, unless it is desirable to shorten a long tail.²⁰ The anchor hitch is also a good choice for tying a throwline to a throwbag.

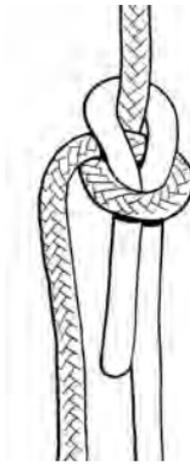


Tying Tips

- When using the anchor hitch with a traditional climbing system, tie the knot without the biner in place. By doing so, you avoid having to pass the long tail twice around the biner.
- To untie the hitch, simply push against the “bar” of rope that encircles the standing part of the line (marked X in fig. 3).



Bowline
loop to throwbag



Attachment bowline

Some tree workers also use the bowline for securing a throwline to a throwbag (*above left*) and a throwline to a rope (p. 18). In the former application, the loop formed from making the knot is girth hitched around the ring of the bag. In the latter application, the same bowline loop is used (along with a series of half hitches) to secure the throwline to a rope that is being installed in the tree.

Finally, when you learn the bowline, you also learn the sheet bend. It's the same arrangement of rope parts, only the sheet bend is tied with two separate ropes of dissimilar size, and sometimes stiffness as well. Either way, attachment bowline (*above right*), or sheet bend, both offer a quick way of securing another rope to a climbing line to be sent to a climber aloft. Just remember, when using the bowline to join lines of different diameter, the smaller (or more supple line) should be used to form the "rabbit hole" of the knot. And, like the sheet bend, a slipped version of the bowline can be tied as well, providing a quick release for separating the two lines.

There are four other bowline knots that are extremely useful in tree work. The bowline on a bight is presented on page 124, and the slip knot bowline, running bowline and triple bowline (sometimes called a three loop bowline) are presented on pages 159-160.

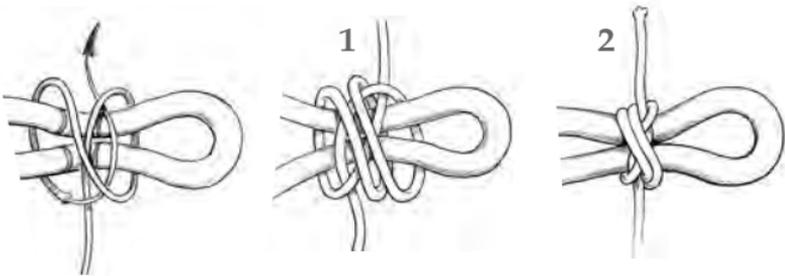
Constrictor Knot

USE IT FOR

- ◆ Seizing an end on a Prusik loop to form a tight eye: p. 47
- ◆ Sending gear aloft: p. 76-77
- ◆ Securing unraveling rope ends.

THE CONSTRICTOR KNOT was the cave man's equivalent to the modern day zip tie. So tenacious is its grip, that if tied too tightly, especially in small diameter cordage, it can easily become a "knife knot." Among other things it makes a great seizing to form an eye in a Prusik loop (*see below*) or to shorten the eye of a long eye splice. Though the constrictor has limited use in tree work, the innovative tree worker could most assuredly tap its potential and expand its application.

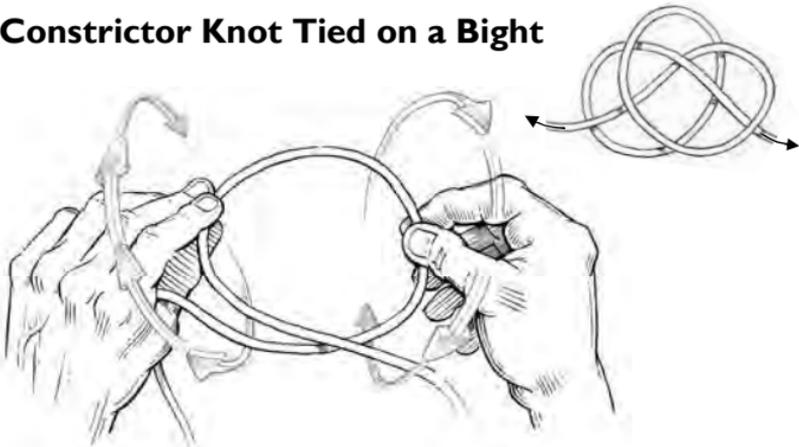
Constrictor Knot Tied with the End



Single constrictor

Double constrictor (for extra cinching power)

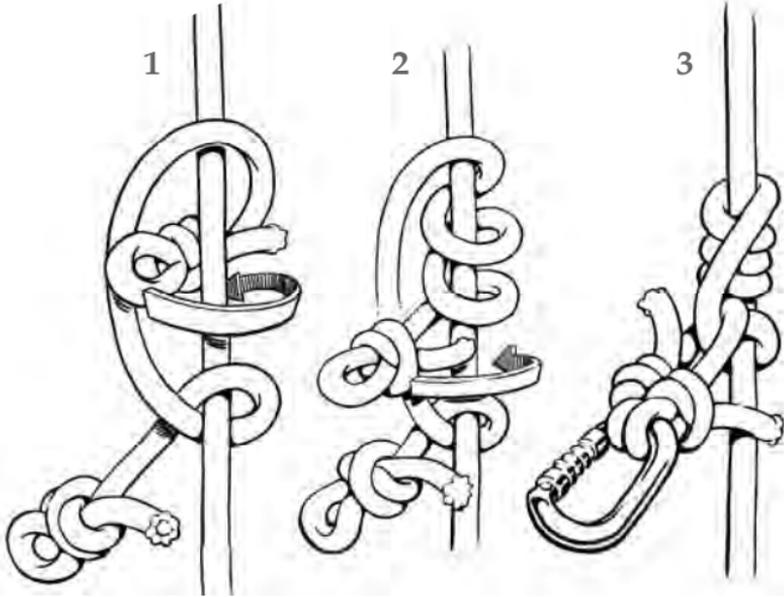
Constrictor Knot Tied on a Bight



Distel Hitch

USE IT FOR

- ◆ Climbing hitch for split-tail system: p. 25-26, 32-34, 36
- ◆ Lanyard length adjuster: p. 70

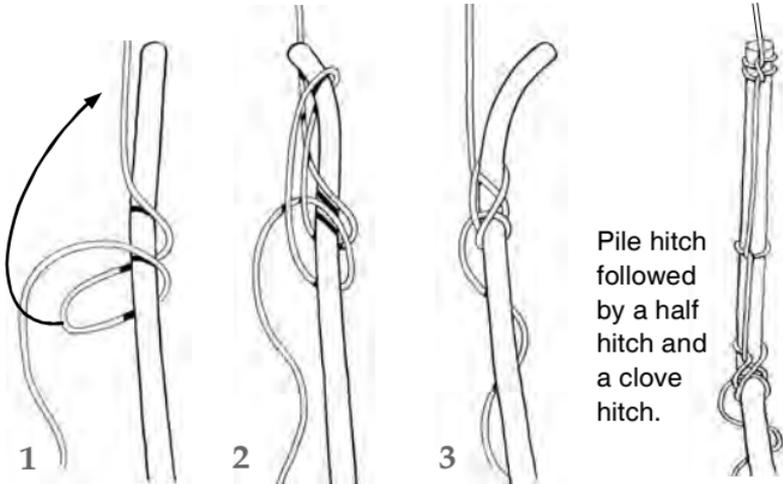


THE DISTEL HITCH (pronounced *dee' stil*) should look familiar to those of you who have used the tautline hitch. Though very similar in construction, the Distel is unlike its cousin in that it is a closed climbing hitch (tied with a double-eye split-tail) and used exclusively with a split-tail climbing system. Used in this fashion, the Distel does not experience the problems of the tautline, therefore making it a superb climbing hitch. How effectively the Distel will grab the line and release ("break") afterward is determined by the number of turns taken with the hitch. This number is, in part, determined by the length of the split-tail sling. The most common number and configuration of turns is the *4-over-1* (as shown above). That is, four turns in one direction and one turn in the other. But like all the climbing hitches, more or less turns can be taken as long as it does its job.

Pile Hitch

USE IT FOR

- ◆ *Securing a throwline to a rope: p. 18-19, 55*



OF ALL THE THROWLINE to rope attachments I've tried, the pile hitch has proven to be the quickest to tie and easiest to untie. Even after all the heavy jerking and loading that throwlines are typically subjected to during the installation process, the pile hitch can be easily removed. Simply thumb the bight away from the load strand, and the hitch will loosen enough to allow the knot to be slid off the end of the rope. The pile hitch is frequently backed up with a series of half hitches to make it more streamlined and pass through tree crotches more easily.

In the same way, though in reverse, the pile hitch can be secured to a climbing line to make a canopy anchor system retrievable (p. 55). It's also a good idea to tie an attachment knot, such as the pile hitch, to the end of a climbing line when retrieving a false crotch device from the canopy to protect the heads of people on the ground from falling rope and the rings of the device itself.

Running Bowline

USE IT FOR

- ◆ *Anchoring a climbing line: p. 52; or a pull line: p. 98-99*
- ◆ *Tying off limbs, tops, & trunk wood for lowering: p. 91-97*

YOU JUST NEVER KNOW from whom you will learn something of value. Ironically it was from a customer (an old sailor) that I learned the running bowline early in my tree climbing career. Since then not a day's gone by where we haven't used this valuable knot.

The running bowline is nothing more than a common bowline tied around its own standing part. This allows it to function as a sliding noose that can be tied a considerable distance away from the object being secured. When using this knot to anchor a climbing line in the canopy, or to the base of a tree, it is suggested that it be finished with a Yosemite tie-off for added security (p. 123).

There are two other ways of tying the running bowline that are also useful for the applications listed above. The first is the slip knot method,

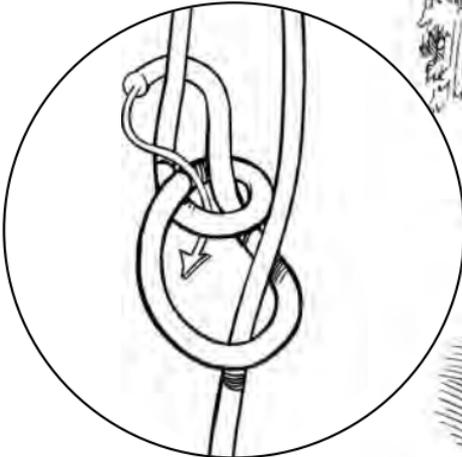


figure-8 descender: metal device used to provide friction on a rope in climbing or very light rigging.

French Prusik: type of friction hitch used in climbing and rigging.

friction hitch: (a.k.a. “sliding friction hitch”) any of numerous knots used in tree climbing or rigging that may alternately slide along and then grip a rope.

knife knot: an expression that describes what is necessary to undo a hopelessly stuck knot—cut it free with a knife (or in some extreme cases, a hatchet).

micropulley: small, light-duty pulley used in climbing operations. Often used as a knot tender.

open climbing hitch: one which the tail end of the hitch emerges from the knot without being attached back to a carabiner, line, or any device (e.g., Blake's hitch).

Portawrap: brand name of a device used to create and manage friction in the lowering line (load line) in rigging operations.

primary support point (PSP): the redirecting limb in the canopy that supports the greater burden of the climber's weight in a basal anchored single rope climbing system. Also referred to as a “primary suspension point.”

recrotching: repositioning a climbing or rigging line in a different and usually more favorable position in the tree.

redirect: 1) *v.* changing the path of a climbing or rigging line to modify the forces on, or the direction of, the line. 2) *n.* a system, or device, installed to change the path of a climbing or rigging line.

rigging point: the place in the tree (natural or false crotch) that the load line passes through to control limb removal in rigging operations.

rope grab: a mechanical device or friction hitch knot tied with rope or webbing that may alternately slide along and then grip a rope.