The WOODLAND HOMESTEAD

HOW TO MAKE YOUR LAND MORE PRODUCTIVE
and Live More Self-Sufficiently in the Woods

Brett McLeod

Foreword by Philip Ackerman-Leist

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Storey Publishing

ACKNOWLEDGMENTS

While *The Woodland Homestead* is about my 25-acre freehold in the Adirondacks of northern New York, it is also something more: it's a collection of ideas, techniques, and experiments in self-sufficiency that have come from others trying to carve out a better, more rooted life in this admittedly inhospitable region. Among those to whom I'm most indebted are my closest neighbors: Ralph, Mike, Elaine, Tom, Rose, Dan, Sara, and Joe. I'm also grateful to the local Amish community in Burke, New York, which has enthusiastically shared its traditional way of life and routinely makes a point of demonstrating the virtues of horsepower over machine power. I'd also like to thank my students and colleagues at Paul Smith's College for excusing me when I arrived late to class on horseback and for continuing to act excited when I bring them armloads of stump-grown squash from my forest garden. Two former students, Billy and Marin, deserve special thanks for their feedback on this book; they will no doubt both be fabulous woodland homesteaders someday. I'd also like to thank Alesia, Joy, and Tatiana for encouraging me to pursue this book in parallel with my dissertation work at Antioch University New England. Throughout the book you'll also find a number of profiles of innovative homesteaders; thanks to all of them for sharing their expertise.

Writing a book is an exercise in both faith and endurance. I'd like to thank writer, homesteader, and friend Jenna

Woginrich for telling me, "Of course you need to write a book." That's faith. I'd also like to thank my editor, Carleen Madigan, for her solid vision, good wit, and sage advice. Finally, I'd like to thank all my family and friends who tolerated me while I worked on this book. You are all saints.

To my parents, Bill and Patty, who gave me my first axe at age five, and my first chainsaw at eleven.

Who would have known?

Contents

Foreword

If you've ever been out "cruising a timber stand" with a forester, chances are you've encountered a wedge prism: a small beveled piece of glass that the forester holds at arm's length and looks through to determine which trees are to be tallied and which ones are "out." (Brett gives you the homesteader's version of this expensive device, made out of a penny, within the first ten pages of this book. So by the time you buy the book, you've already saved money!)

Well-versed in such professional prescriptive assessments of a forested parcel, Brett McLeod nonetheless opts to trade in the wedge prism for a viewing glass that is kaleidoscopic in nature. When you start reading *The Woodland Homestead*, Brett will have you looking in multiple directions all at once: forward, backward, up, down, winter, summer. Your woodlot will become an endless and evolving source of projects and products. You'll learn how to think about your woodland not only as an ecosystem but also as an "ecology of possibilities."

Homesteaders like myself have too often thought of the homestead as a requisite clearing in the woods. In fact, a retrospective of Western and particularly American history begins to look like a history of clearings, paving the way (quite literally now) for civilization. I would argue that we need more gems like *The Woodland Homestead* to remind us of the pathways back to a more deeply cultured future, one that understands the forces of nature as allies and not perpetual antagonists, one that appreciates the shadows as much as the sunlight.

Crafting one's place in this world is a nearly a lost art, and Brett's sage advice on how to bring an axe back to life is as much a metaphorical statement as it is a practical guide. To bring back the axe is to rekindle the warm satisfaction of well-honed skills (even if you are personally a bit rusty) — to opt on occasion for restoration in lieu of simply buying into a manufactured existence.

Coppicing, living barns, silvopasture, the forest as larder and pharmacy . . . it's all here. What follows are pages upon pages of the wisdom of a master — someone who has set out to master not the forest but rather the skills needed to live as part of a thriving ecosystem that produces far more value than "stumpage." Indeed, we live in an age of stumps, but this book challenges the notion that a forest's value is best measured when the trees are all horizontal.

You may not be able to judge a book by its cover, but you can darn well measure an author by his or her home. The first time I entered Brett's home deep in the Adirondacks, I walked into an artisan's homage to the landscape and the traditions surrounding him. Brett's home is as much of the woods as it is in the woods. May you be as inspired by his book as I am by his homestead, his wisdom, and his wit.

— PHILIP ACKERMAN-LEIST
author of *Up Tunket Road: The Education of a Modern Homesteader* and *Rebuilding the Foodshed: How to Create Local, Sustainable, and Secure Food Systems*

Preface

Why anyone chooses to homestead remains a mystery to many, especially my mother. Why would a person choose to give up the comforts of modern living and consciously return to a point in time when life was tougher, grittier, and less forgiving? I've wrestled with this question myself; it seems even more valid when you're chasing hogs down the highway or building a log cabin with an axe because that's what Granddad did. However, long after the blisters have turned to calluses and the neighbors have been paid off with eggs for the hogs rooting up their yards, I'm left with a simple conclusion: it's just a better way to live.

This conclusion isn't entirely my own. I've had the pleasure of integrating homesteading and my particular flavor of it — *woodland* homesteading — into my work as a professor of forestry and natural resources at Paul Smith's College, and as a doctoral student at Antioch University New England. The lessons that come out of this book represent not just my own trials and tribulations but also ideas from over a dozen woodland homesteaders who have chosen to live, work, and play in places that most would write off as "too wild" or "not farmable." The result is a collection of ideas and techniques from the most innovative and resourceful folks you've ever met — people who see an impenetrable clump of trees as low-cost animal housing, or a high-graded stand of timber as a community woodshed. This ability to develop perspective, see opportunity where others do not, and then offer ingenious and innovative solutions is the mark of a woodland homesteader.

Realizing your dream of a woodland homestead is tough work, requiring both sweat and patience. The productivity of your woodland can be highly variable and will be dependent on climate, soils, and how the land was used by previous owners. What this book offers is a new lens for taking stock of your woodland, with the goal of unlocking its untapped potential. This perspective minimizes commercial production of forest products and instead focuses on maximizing utility for you, the woodland homesteader. By combining new perspectives with old ideas, we're likely to reveal homesteading's most fundamental lesson, eloquently summarized by Wendell Berry: "When going back makes sense, you're going ahead."

CHAPTER 1

Seeing the Forest

Through the Trees

How to Unlock Your Woodlot's Potential

Many homesteaders devote themselves to carefully making plans for their garden, hoop house, or chicken coop, but they overlook the homestead woodlot. Just beyond the edge of your lawn is a hidden gem, disguised as thick brambles and gnarled trees. If properly managed, these patches of woodland — whether a quarter acre or a hundred acres — offer you the opportunity to cultivate both additional ground and a more sustainable, self-reliant homestead.

Just What Can The
Woodland Homestead Offer?

CONSIDER THIS

In a single year, on a 1-acre homestead forest, you can do the following:

GROW A FACE CORD OF FIREWOOD, using long-lost forestry methods that date back to medieval Europe.

HARVEST FIVE BUSHELS of fruit from your homestead orchard.

MAKE TWO GALLONS of maple syrup.

SAVE MORE THAN $200 by growing your own fenceposts.

GROW $100 of wild mushrooms.

SAVE MORE THAN $300 on feed for your small livestock by using natural forage.

GROW ENOUGH WILLOWS WHIPS to weave a basket for your bountiful harvest.

TAKING STOCK

The first step in realizing the dream of turning your woodlot into a woodland homestead is to take stock of both the potential of your land and your goals for it. As part of this process, it's important to conduct a basic inventory. This inventory will tell you if your ambitions are in line with the potential of your land. If, for example, your goal is to produce firewood through coppice sprouting (described in **chapter 4**) and your inventory reveals that your woodlot is entirely white pine (a species that isn't ideal for firewood and doesn't coppice), you'll need to either reevaluate your goals or come to terms with the time and energy needed to convert your forest to a coppice system. On the other hand, an inventory may reveal opportunities that you never considered. Imagine, for example, discovering a long-lost orchard or a wild grape vineyard just begging for a little help.

A basic woodlot inventory should consider parcel size, topography, site access, species composition, and forest structure. It's worth mentioning that while the terms "woodlot," "woodland," and "forest" will be used throughout the book, we're obviously talking about a much wider range of goods than just commercial wood products.

MEASURING THE WOODLOT

Woodlot size is the obvious starting point, because it will allow you to evaluate your wants and needs in the context of the land's capacity. If, for example, you know you need five cords of wood to heat your home for the winter, but your woodlot is only a quarter of an acre, you'll quickly realize that you won't be able to sustainably fulfill all your firewood needs. (See **here** for tips on estimating firewood production potential.)

So how do you estimate the size of your land? If your woodlot is roughly square or rectangular, simply measure and multiply the width by length to get the total square footage. To convert to a per acre basis, divide by 43,560, the total number of square feet in an acre. If the land you're measuring either is very large or includes difficult terrain, it may make more sense to estimate the length and width by pacing rather than by using a tape measure or measuring wheel. Most people have a pace (two steps) that measures between $4\frac{1}{2}$ feet and $5\frac{1}{2}$ feet, though it's useful to calculate your own pace for more accurate measurements (see **Pacing 101**).

For irregularly shaped land parcels, consider using aerial photographs, which are available online, along with conversion tools for determining the exact size of your lot by digitally tracing the perimeter of your property with the click of a mouse. Walking the boundary to measure a parcel also gives you an opportunity to evaluate the topography, or lay of the land. You'll want to note the location of areas that could be problematic, including swamps, cliffs, or even poison ivy patches. Also note areas that might offer greater efficiency in laying out your wooded homestead. These may include south-facing slopes (ideal for early-season growing), existing trails, and natural springs.

WHAT KIND OF WOODLAND DO YOU HAVE?

When foresters talk about “species composition,” they are usually referring to both the number of tree species present and the relative abundance, or percentage, of each species. Having a good gauge of species composition, size, and age of these trees (forest structure) is considered essential to managing your woodlot, regardless of your goals.

Foresters use a variety of statistical tools to inventory woodlots, but in this section we’ll describe just one of the simplest techniques: fixed-radius plot sampling. The goal of all forest sampling is to accurately inventory the woodlot without having to count or measure every tree. Once you have an accurate inventory, you’ll be able to develop realistic and manageable goals for your homestead.

PACING 101

If you're not sure of your own pace, you can easily calibrate it yourself. Here's how:

- Measure a known distance using a tape measure. Longer is better (200 feet is good), and will yield more accurate results.
- Start out with your right foot as the first step, and count every time your left foot hits the ground. This double step represents one pace.
- To calculate your pace length, divide the course length by the number of paces. In my case, the 200-foot course took 40 paces, giving me a 5-foot pace (see below).

It may be useful to calibrate your pace on different terrain. Your pace will shorten going uphill and lengthen going downhill.

Distance to Pace	If You Have a 4½-Foot Pace	If You Have a 5-Foot Pace	If You Have a 5½-Foot Pace
100 feet	= about 23 paces	= 20 paces	= about 19 paces
200 feet	= about 45 paces	= 40 paces	= about 37 paces
300 feet	= about 67 paces	= 60 paces	= about 55 paces

Fixed-Radius Plot Sampling

To begin fixed-radius plot sampling, you'll need a 50-foot flexible tape measure and a notebook to record your field notes. While this procedure can be done alone, you'll find it much faster (and more enjoyable) if you're able to find a friend to help. Using circular plots instead of squares or other shapes is preferable for a couple of reasons: circles are faster to lay out than other shapes because trees can be inventoried using a sweeping motion, much like the arms of a clock. This ensures an efficient and accurate inventory, free of "missed" trees.

Determine the Size and Number of Plots Needed

Obviously, smaller plots are faster and easier to inventory than larger ones, but you'll also need more of them to construct an accurate sample. An accurate inventory for most woodland homesteads can be derived from a 10 percent sample. To illustrate this, let's consider the following example. Imagine you have a 10-acre woodlot. If we stick to a 10 percent sample, that means that we'll need to inventory a total of 1 acre. Of course, we wouldn't want to just inventory, say, the 1 acre closest to the barn, because that wouldn't necessarily be representative of the other 9 acres. Instead, let's make 10 plots, each $^1/_{10}$ of an acre, and distribute them randomly throughout the woodlot. Using basic geometry, we determine the radius of a $^1/_{10}$-acre plot to be 37.2 feet.

Determine the Plot Locations

A common error in forest sampling is placing the plots in locations that are convenient as opposed to truly random. This often results in a forest sample that underestimates what is actually there, because of the sampler's propensity to naturally gravitate toward more open areas. Conversely, seeking out big trees can lead to *over*estimating.

If the woodlot is fairly uniform in composition, one common sampling technique is to lay out a transect line (a predetermined bearing for sampling) through the woodlot, and place the plot centers equidistant along a line. If the woodlot is large enough, multiple sample strips may be created; just make sure that your sample plots don't overlap. Similarly, make sure that your first and last plots along the line fall entirely within the forest, and not on a road or field edge that would make your sample artificially low.

Plan Your Inventory and Goals

What types of products you'd like to harvest from your woodland will determine the kind of data you need to collect. For example, if you want to harvest trees to saw into lumber, estimating the number of logs in each tree will be important. On the other hand, if promoting animal forage or shade for livestock is your goal, log volumes are likely irrelevant. In any event, you should collect information on the tree species, diameter at breast height (**DBH**), and relative condition of the trees (living/dead/diseased). This information is easily arranged in columns in a notebook; just be sure to keep track of which trees are located in which plots.

Begin Your Inventory

Being able to identify the trees in your woodlot is the first key to beginning your inventory and, ultimately, managing it. If you’re unsure of the species, you can consult your local natural resource agency or Cooperative Extension office. For suggested field guides, see **Resources**. Once you have identified your plot centers (I like to tie colored flagging to a wood stake), take a compass bearing to mark your beginning point. To be consistent, I usually start with a true north bearing. Working from the plot center to the outside edge (37.2 feet for our example), systematically record each tree’s species, diameter (>1 inch DBH), and condition. You can also cut a rope or string to length, which will maintain the proper radius and save you from repeatedly rolling and unrolling your tape measure.

Until you get the hang of taking the diameter of trees at breast height, you may want to use a stick cut to 4 1⁄2 feet as a way to ensure accurate measurement. Measuring the diameter of the tree can be done with a variety of forestry tools (a Builtmore stick, tree calipers, or diameter tape), but you can also use the same measuring tape that you used to find the plot radius and simply wrap the tape around the tree at breast height to find the circumference. Converting from circumference to diameter is just a matter of dividing the circumference by pi (3.14). The chart **here** offers an example of how you might organize your field notes.

Tally Your Results

Once you’ve sampled your forest, it’s time to convert the data into usable results. In our example we sampled 10 plots, each 1⁄10 acre. This means that we inventoried 10 percent of our woodlot, or 1 acre total. This is a convenient sampling strategy because it means you simply add all the trees together to get your results on a per acre total. Being able to describe the forest on a per- acre basis is important because it allows you to understand whether the forest is overstocked (too many trees), understocked (too few trees), or somewhere in between, based on your management goals. Calculating the average diameter by species and the relative abundance (percent of each species) is also useful for establishing management objectives for your woodlot.

Use Your Data to Make Decisions

The results of your inventory will tell you whether your objectives match what your forest is able to provide. A logical starting point is to look at species composition; in other words, what trees are growing on your land and how abundant they are. The simplest breakdown is a split between coniferous (cone-bearing) and deciduous (leaf-bearing) species. In general, conifers are better at growing close together, meaning that you can have more trees per acre without the forest being overstocked or crowded. The conifer/deciduous split is also useful for understanding site quality, with deciduous trees generally preferring less-acidic soils.

Examining what species are present tells you not only what's possible in terms of present output but also what the future potential of the forest is. A forest with a lot of sugar maple trees suggests potential as a future sugarbush. A densely packed forest of tall red pine trees, on the other hand, is destined to be reincarnated as a log cabin.

INVENTORY FIELD NOTES

Plot Number	Species	DBH (to the nearest inch)	Condition	Notes
1	Red maple (*Acer rubrum*)	8	Healthy	Large crown
1	White pine (*Pinus strobus*)	15	Dying	Recent lightning strike
1	Paper birch (*Betula papyrifera*)	4	Suppressed	
1	American beech (*Fagus grandifolia*)	5	Dying	Signs of beech-bark disease
1	Wild apple (*Malus* spp.*)	6	Healthy	
1	Black cherry (*Prunus serotina*)	12	Healthy	Crooked
1	Bigtooth aspen (*Populus grandidentada*)	6	Healthy	

*The abbreviation "spp." refers to the fact that a wild apple may be from any of number of different species within the genus.

HOW BIG ARE YOUR TREES?

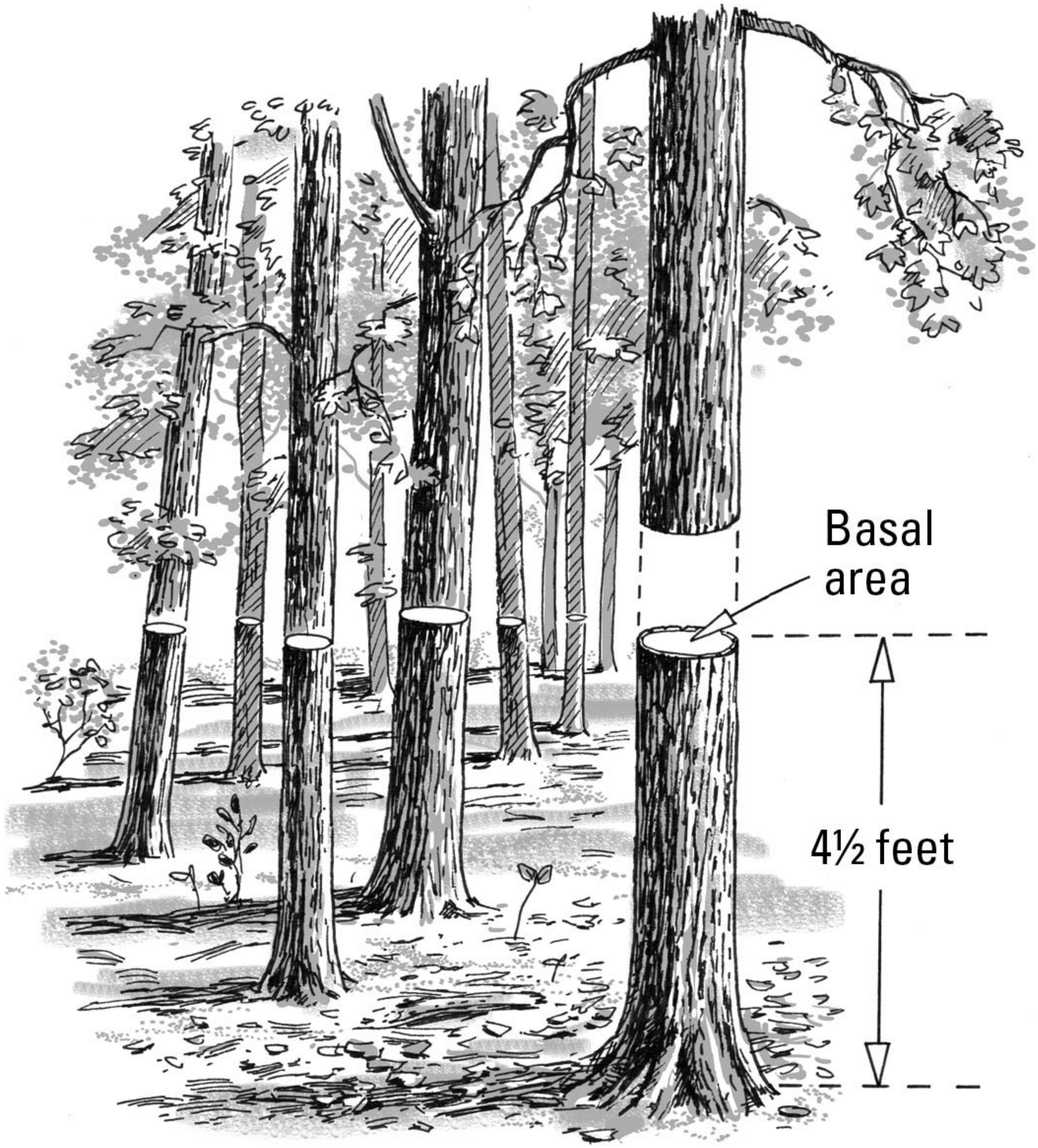
Species and number of trees per acre only tell part of your woodland's story. The size of the trees is also important. Imagine a dense forest with, say, 100 giant old-growth oak trees per acre. Now imagine a 1-acre field with 100 oak seedlings. Both "forests" have 100 trees per acre, but they are quite different.

Calculate the Basal Area

Foresters use the concept of basal area to describe the amount of forest occupied by trees. One way to visualize the concept of basal area is to imagine a freshly cut forest full of breast-height stumps. If you were to tally the total area of 1 acre of this forest covered in stumps (expressed in square feet), that would be the basal area per acre. This is a useful metric of stocking because it takes into consideration the size of each tree, not simply its mere presence. The basal area of each tree can be calculated from the diameters you recorded for each tree in your field book by squaring the diameter, then multiplying that number by 0.00545415. As an example, consider the 15-inch DBH white pine in our tally sheet. The area represented by that one tree is calculated as follows:

$$(15 \times 15)(0.00545415) = 1.23 \text{ square feet}$$

However, if all this math is taking the fun out of managing your woodlot, consider using the point sampling method, which offers a quick-and-dirty way to determine basal area. (See **Point Sampling with a Penny and a String**) This is considered by many to be the most essential forest measurement tool. Best of all, it only requires a penny and a string.



ABOVE: *Basal area can be thought of as the total area (usually within an acre of land) occupied by stems 4 ½ feet above the ground. Calculating the basal area of your woodlot will help you understand whether it's over- or understocked.*

EVALUATING YOUR OPTIONS

If you've made it this far, you should be congratulated on surviving Woodlot Math 101. Now that you've completed a full forest inventory, or at least a basal area count, you're able to begin objectively analyzing the woodlot and evaluating your options as a landowner.

As previously mentioned, the number of trees per acre is of limited value since it says nothing of the trees' size (though it does tell us about the future potential of the forest, as discussed in the following section). Basal area, in contrast, can be extremely useful for making management decisions related to stocking, or the amount of wood in your woodlot. As in a garden, if there are too many plants competing, nothing will thrive. Conversely, if there are too few plants, growing space isn't maximized.

Generally, conifer forests will have a higher basal area because their conical shape requires less growing space. The sprawling crowns of deciduous trees take more space, thereby reducing the optimal basal-area target. As a general rule, you'll want to shoot for 120 to 220 square feet of basal area per acre for conifer stands, and 80 to 150 square feet of basal area per acre for hardwood stands. Remember that these are just guidelines, though, and are subject to change based on specific forest conditions and your goals as a landowner.

To further illustrate this point, imagine you have a 10-acre woodlot that you wanted to manage for firewood, maple sap/syrup, animal fodder, and fruit production. Let's assume that this forest consists primarily of a mix of sugar maple, American beech, and quaking aspen, along with a few wild apple trees. Using the information collected during the inventory, we find that the woodlot has 210 square feet of basal area per acre and that more than 50 percent of the trees are sugar maples, ranging in size from 2 inches to 15 inches DBH. This alone tells us several things.

First, at 210 square feet of basal area per acre, this hardwood forest is severely overstocked, meaning that the trees are crowded, especially if we're looking to produce maple sap, which is dependent on having large, sprawling crowns (think more like 50 square feet of basal area per acre). The high proportion of sugar maple trees is encouraging, but depending on their size distribution, at least some of the sugar maple trees will likely need to be removed. The presence of beech may be either a blessing or a hindrance. On the one hand, if the trees are healthy and producing nuts, you have a potential gold mine. On the other hand, if the trees suffer from beech-bark disease, which is a common malady in the Northeast, removing them for firewood and then implementing a coppice firewood harvesting system might make more sense. As for the apple trees, it will be important to release and prune them, since shaded fruit trees will have lower fruit yields than those in full sun.

This simple example is meant to illustrate how you might approach your woodlot in a way that's logical and considers multiple factors simultaneously. However, there's plenty that an inventory won't reveal about the landscape that can only be understood by developing a "woodland eye."

YOUR WOODLAND EYE

Beyond the science of creating an inventory for your woodlot is the art of developing a woodland eye. A skillful woodland eye is able to read the landscape like a history book, teasing apart past uses and recognizing potential opportunities.

Geography will dictate your starting point for reading the land. I grew up in New England, where a neighboring farmer taught me the art of reading stone walls as if they were inscribed with dates and a timeline of their uses. Later I moved to Alaska, where fellow lumberjacks taught me to age stumps on the basis of not only their decay but also the axe marks, including the scarf of the notch and the mysterious "pockets" that were chopped into the side of the trunk to support a "springboard" in lieu of level ground. I now homestead in the Adirondack Mountains of northern New York, where the landscape offers its own set of clues about the past as part of an enduring yet humble history. Hand-dug and dry-laid foundations point to a time when subsistence homesteading prevailed over production agriculture. This is also indicated by modest pastures, small orchards, and family-size root cellars. To these early homesteaders, managing their land for fuel, food, and animal fodder was essential to becoming more self-reliant. In many cases a mix of traditional knowledge, folklore, and trial and error helped homesteaders read the land and create the most productive woodland homestead possible.

While we may not have the benefit of farmer or forester lineage, we can still develop a woodland eye. Let's start at ground level and work our way through the woodlot.

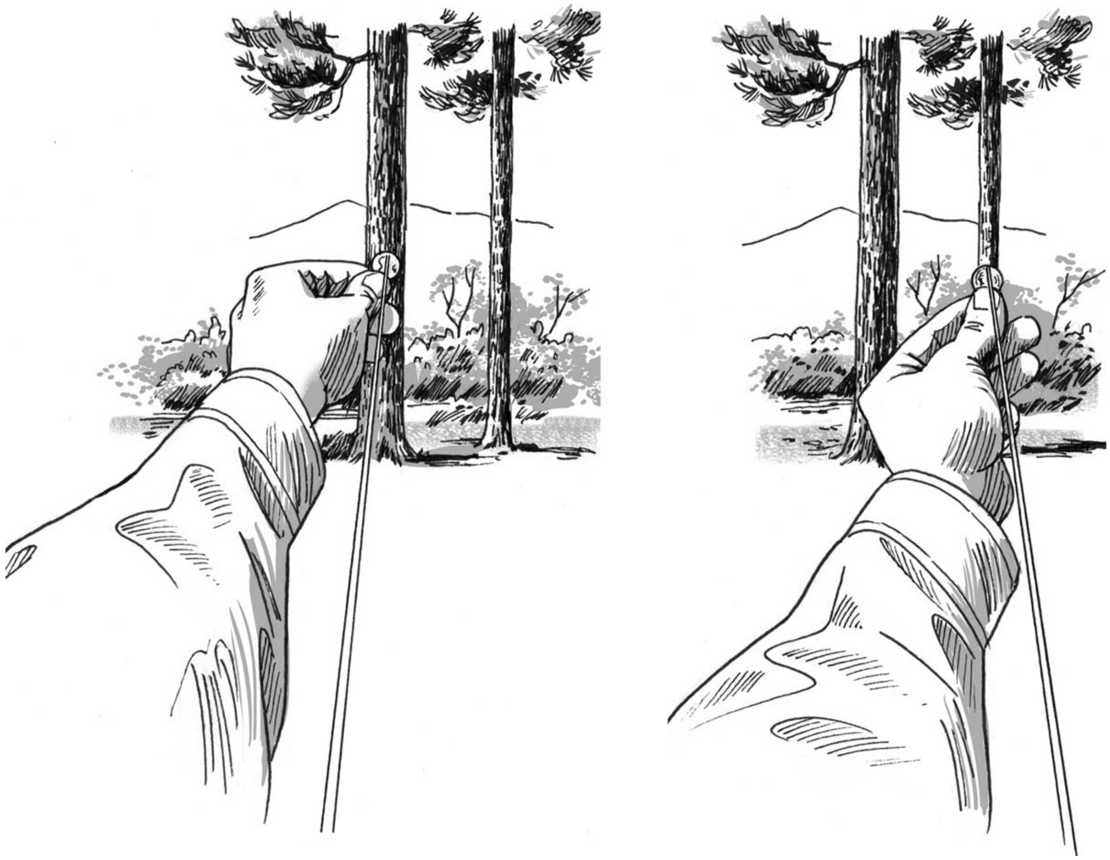
POINT SAMPLING

With a Penny and a String

Instead of using fixed-radius plot sampling, some foresters use a method known as point sampling (or variable-radius plot sampling), which samples trees based on size rather than on how frequently they are found in the woodlot. This is particularly useful if you're managing for timber or firewood or looking to grow a sugarbush.

You can lay out your point sample the same way you'd lay out a fixed-radius plot, along a transect line with predetermined plot centers. However, instead of having a fixed plot area, your plots will be variable and based on the size of the trees in the woodlot. Handy for us, a penny is just the right width for representing 10 square feet of basal area when held approximately 25 inches from your eye. To get that distance just right, tape a 25-inch string to the side of the penny, holding the string by your eye with one hand, and the penny outstretched with the other. Starting at a known bearing (again I recommend true north), look down the string at the penny and line it up with the tree closest to you at breast height. Does the penny extend beyond the width of the trunk? If so, it's "out" and won't be counted. If, in contrast, you can see the trunk on either side of the penny, the tree will be counted, measured, and recorded as "in." If there are a number of trees for which the penny lines up perfectly with the width, you'll want to count every other tree as "in." Once you've counted all the “in” trees, simply multiply by 10 to get the number of square feet of basal area per acre. This number will serve as a useful guide as you begin managing your woodlot.

Many people ask how this method could work since trees that are farther away from the plot center will appear smaller and will therefore likely be counted as “out,” while a similarly sized tree located closer to the plot center would be counted as “in.” The magic of these variable-radius plots is that there is a fixed relationship ratio involving the length of the angle’s sides and the distance between the two sides at any point. Using a penny just happens to create this perfect angle to allow for accurate sampling without the need for a fixed radius. Another way to think about this is that the penny gauge is able to geometrically reconcile and adjust for close or far trees by virtue of an angle that decreases the odds of being “in” as distance from the center point increases.



ABOVE: *The tree on the left would be considered "in"; the tree on the right would be considered "out" and wouldn't be tallied.*

DBH

What's It All About?

Early woodsmen established diameter at breast height (DBH) as a standard measurement for tree diameters. DBH is measured 4½ feet above the ground. If you find yourself measuring on a hillside, make sure you take the measurement on the uphill side. Why measure so high? There are a couple of reasons. First is practicality: 4½ feet is a comfortable height for working, since each tree is measured with either a diameter tape or, in some cases, a set of calipers. The second reason is that most trees have flared or fluted butts that taper drastically in the first few feet; if we were to measure closer to the ground, we'd likely overestimate the tree's volume. Finally, the height of the measurement means that inventory work can be completed year-round, even if the ground is covered in snow. Just make sure to use a sharp stick or old ski pole as a staff to ensure you're really measuring the height from ground level.

SOIL TYPES AND TREE COMMUNITIES

Truly understanding the potential of your woodlot requires an underground history lesson that that helps explain what grows where, and why. Sometime during the last glaciation, which began about 40,000 years ago and ended about 11,000 years ago, an ice sheet several kilometers thick covered most of the northern United States and Canada. As the ice melted and receded north, what remained were landforms dominated by glacial till and outwash. Glacial till consists of poorly sorted materials (silt, sand, pebbles, cobbles, and boulders) that were deposited directly beneath and at the front of the ice sheet, or along the sides of valley glaciers. Much of the landscape was covered with a mantle of till after the ice retreated; till-dominated landforms included rolling, hummocky moraines and teardrop-shaped drumlins. Outwash is relatively well-sorted sand and gravel that was deposited by fast-moving glacial meltwaters that formed near the front of the retreating ice. Outwash deposits are common on broad valley floors or as sand-and-gravel terraces on valley walls where meltwater streams entered glacial lakes.

TESTING YOUR SOIL

While indicator species and the physical properties associated with soils offer a good starting point for evaluating the growing potential of your woodlot, basic soil tests offer a way to assess and quantify the chemical properties of your soil, which is important to ensure that your desired plants are getting the nutrients they need to be part of a healthy woodlot community. The most basic soil test evaluates pH, or the alkalinity/acidity of soil. In the context of woodland homesteading, this will be your most important piece of data. Additional data regarding nutrient levels could be helpful if you wished to introduce new plants to the site that may have different nutritional requirements. Below are four soil test options, from basic to sophisticated.

Homemade pH Test

You can determine whether your soil is alkaline (sweet) or acidic (sour) using a couple of ingredients in your fridge. Begin by collecting approximately ½ cup of the soil you'd like to test. Be sure to dig down deep enough so that you're collecting the actual soil and not the surface duff. With your soil sample in a glass jar, add ½ cup of vinegar and watch. If the soil begins to bubble, or make a fizzing sound, it's alkaline. If there's no reaction, take a fresh ½ cup of soil in a new container and add ½ cup distilled water, followed by ½ cup baking soda. If it bubbles or fizzes, you have highly acidic soil. Amending soil on a small scale (around a single fruit tree or berry bush, for example) can be done by adding wood ash or lime if it's sour, or pine needles if it's too sweet. (See **Resources**, for guidelines.)

A pH Test Kit

Your second option is to purchase a pH test kit at your local garden center or hardware store. The most common kits are litmus paper tests (think high school chemistry class). Litmus paper tests are inexpensive and offer reasonably accurate results. As with the first test, you'll have to mix distilled water with the soil to obtain an accurate reading.

A pH Soil Probe

Another option is to use a battery-operated pH soil probe, which gives instant readings, allowing you to easily test the pH on different parts of your property. Soil probes capable of measuring soil moisture, temperature, and other variables are also available but are often cost prohibitive for the frugal woodland homesteader.

Cooperative Extension Service

Your fourth option is to take advantage of your local university Extension service. In most states, the Cooperative Extension Service will conduct a combined pH, nitrogen, phosphorus, and potassium test for a nominal fee (or for free in some places). You will need to provide your own clean container for your dry and clearly labeled soil sample. Soil labs are often overrun with requests for soil analysis in the spring, so consider submitting your sample in late summer or fall, well after the rush.

From an agricultural standpoint, soils that have formed on outwash deposits tend to be nutrient poor, since sand and gravel have very low water retention and cation-exchange capacities (the ability to chemically retain nutrients). However, the absence of larger stones in outwash soils tempted many settlers to try to farm these lands. Some crops, such as potatoes and other root vegetables, are able to grow on outwash, while other crops need the higher nutrient capacity associated with glacial till. The passage of time has converted these old fields to forests, with the current suite of trees offering important clues about the soil below. As a general rule, conifer species are more tolerant of both harsher climatic conditions and nutrient-poor outwash soils or acidic bedrock, while most deciduous species prefer fertile glacial till. The **Dominant Forest Species & Their Uses** chart offers a summary of several common woodlot species, along with their potential uses based on soil quality.

As you develop your woodland eye, you will notice not only individual species of trees but also entire communities.

Foresters often refer to these communities by naming the two or three most common species. In the northern hardwood forest, a common community indicative of good soil fertility would be sugar maple/yellow birch/American beech; in the Pacific Northwest, an example of a common forest community is Sitka spruce/yellow cedar. Also, don’t discount groundcover species as revealing important clues about the soil. Nettles, for example, despite being painfully annoying, are generally an indicator of rich, fertile soils, as are flowering spring ephemerals.

STONES AND THE STORIES THEY TELL

As important as the soil below are the stones on the woodlot floor. Roughly rounded cobbles and boulders are more common on glacial till–dominated sites; these stones have been smoothed by the grinding action of tons of ice advancing across the landscape, pulverizing and tumbling bedrock quarried from the surface. You might also see rock types unlike those present in local rock outcrops; this is a good indicator of material brought to your site from a distance by ice. Angular or jagged stones on the surface might also indicate a relatively thin cover of till and soil, and the proximity of bedrock.

Outwash-dominated sites tend to be flat because the sediments were deposited by running water. Typically, these areas are devoid of large stones on the surface; this is because the sorting process of meltwater streams would have deposited coarse sand to softball-size stones, rounded by water. Jagged stones indicate rich glacial till. The abundance of multiple shapes and sizes of till stones across the Northeast, unfortunately for early homesteaders, meant having to move millions of them each spring. However, as backbreaking as moving them was, the stones provided an important material. In some places, wood was becoming rare by the mid-19th century, but stones were always plentiful.

Reading Stone Walls

Knowing a few things about the construction of stone walls can offer important clues if your property includes these agrarian relics. First, what does the wall look like? Is it haphazardly constructed? If so, it's possible that the wall wasn't even intended to be a wall; instead, it was likely a rock dump for a field that was picked of stones and cultivated each season. Second, how big are the stones? Walls composed primarily of larger stones denote areas that were likely used as pastures or hay fields; small stones (smaller than a softball) would have only been picked in a field that was cultivated. Finally, is the ground higher on one side of the wall than the other? If so, it's likely that the side where the ground level is higher was plowed, with each successive year's furrow stacked upon the last.

Beyond historical interest, these relics offer important clues into the land's history and potential productivity. On my own land I've used these clues to determine which areas will be reclaimed as pastures, which will be silvopastures (a hybrid system that combines grazing land with widely spaced crop trees), and which are best left as working forests. Not surprisingly, the homesteaders who settled the land before me had a good sense of the land's productivity. I've since conducted soil tests throughout the woodlot and pasture, and found that their uses (judging largely by the clues left behind from the stone walls that surround them) represented the optimal matching of site fertility and use. This historical knowledge, etched in the land, should not be ignored by the modern woodland homesteader.

FOREST SUCCESSION: IT'S A TOUGH NEIGHBORHOOD

Because forests evolve over eons, it's easy to forgive the casual observer for assuming that forests are more or less static. In reality, forests are a dynamic, ever-changing community where competition and adaption determine what dies and what thrives. During the establishment stage, trees compete with one another for growing space and sunlight. In terms of their light needs, trees may be classified as either shade tolerant or shade intolerant. Shade-tolerant species tend to be slow growing and have photosynthetic mechanisms that allow them to survive under low light conditions, particularly during the seedling and saplings stage. Shade-intolerant species are vigorous and in search of direct sunlight.

The Succession Process

In most forests, both shade-tolerant and shade-intolerant species are present, though not necessarily at the same time. To better understand this, let's take a look at how forest succession actually plays out.

Grass to shrub. The existence of grasses and forbs (flowering plants that are not grasses) indicates frequent disturbance, which prevents further succession. This disturbance could take the form of a farmer mowing a field or nature sparking a wildfire. In either case, the establishment of woody plants is prevented, allowing grasses to dominate. However, a lack of disturbance, even for just a couple of years, is enough time to allow woody shrubs and shade-intolerant trees to establish.

Sapling to pole. This is the stage marked by intense competition. Grasses and shrubs are shaded out by shade-intolerant saplings that achieve rapid growth. Shade-tolerant species begin to establish in the understory.

Young forest. This kind of forest is marked by increased competition for growing space. The weaker (and usually shorter) shade-intolerant trees begin to die. Shade-tolerant species take advantage of the gaps created through mortality.

Mature forest. Competition-based mortality continues; only the strong survive. Both shade-tolerant and shade-intolerant trees share the main canopy. In mixed conifer stands, distinct layering among shade-tolerant and shade-intolerant species may occur, whereby more shade-tolerant individuals establish under a layer of less-tolerant species.

Climax forest. Shade-tolerant species dominate the site and are able to reproduce in the understory. Shade-intolerant species are unable to reproduce.

DOMINANT FOREST SPECIES & THEIR USES

While this chart is intended to be a guide, realize that which species are present is also a function of forest succession, in addition to relative fertility.

Dominant Species	Soil Summary (relative fertility)	Potential Uses Based on Soil Quality
American basswood (*Tilia americana*)	Fertile; deep, moist soils	This species is sought by bee-keepers for producing a unique, spicy honey. The wood is prized by carvers and woodworkers for its straight grain and low density.
American hornbeam (*Carpinus caroliniana*)	Intermediate; deep, moist soils	This species coppices easily, and will regenerate under moderate light. The wood has outstanding strength, good for tool handles.
Black cherry (*Prunus serotina*)	Poor/intermediate; well-drained soil	On poor sites coppice firewood may be its best use; on more fertile sites consider growing lumber.
Black locust (*Robinia pseudoacacia*)	Prefers rich, loamy soils, but will grow on a variety of sites including abandoned pastures	Native to the Appalachian Mountains and Ozark Plateau, this species is considered invasive in some areas. Black locust makes rot-resistant fenceposts capable of lasting a century.
Paper birch (*Betula papyrifera*)	Poor; can handle a variety of moisture conditions	This species is good for coppice firewood.
Red pine (*Pinus resinosa*)	Poor; well-drained soil	Consider managing this site for producing lumber for homestead projects; red pine makes great log cabins.
Red spruce (*Picea rubens*)	Intermediate; well-drained soils	Fall/winter-harvested logs will retain their bark; these are great for constructing a rustic, bark-on log cabin. The sap can be used for chewing gum or made into resin.
Scots pine (*Pinus sylvestris*)	Dry, infertile soils	Fast-growing trees often develop a gnarled form, making the wood ideal for rustic furniture construction.
Sugar maple (*Acer saccharum*)	Intermediate/fertile; well-drained soil	On quality sites sugar maple produces valuable lumber. On less-fertile sites you may consider maple production or firewood.

AWESOME AGS

& Ugly UGS

From time to time you'll hear foresters refer to trees as being acceptable growing stock (AGS) or unacceptable growing stock (UGS). For a forester concerned with timber production, AGS are generally those trees capable of producing quality logs. UGS are usually culled based on their form (crooked, forked, or twisted) or because of some sort of natural or mechanical damage (insects, disease, fungi, cracks, or wounds). However, you may discover that what would be a defect in a timber market may be an asset in your utilitarian-focused woodlot. For example, a decaying elm tree may be UGS to a forester but AGS to a hungry homesteader looking to harvest wild oyster mushrooms. Or, in the case of creating shade for livestock, a large, multiforked crown with a short trunk that casts a wide swath of shade (typical UGS characteristics) is likely to be preferable to a taller, narrower crown, typically associated with AGS in the timber market.

Signs of Succession in the Homestead Woodlot

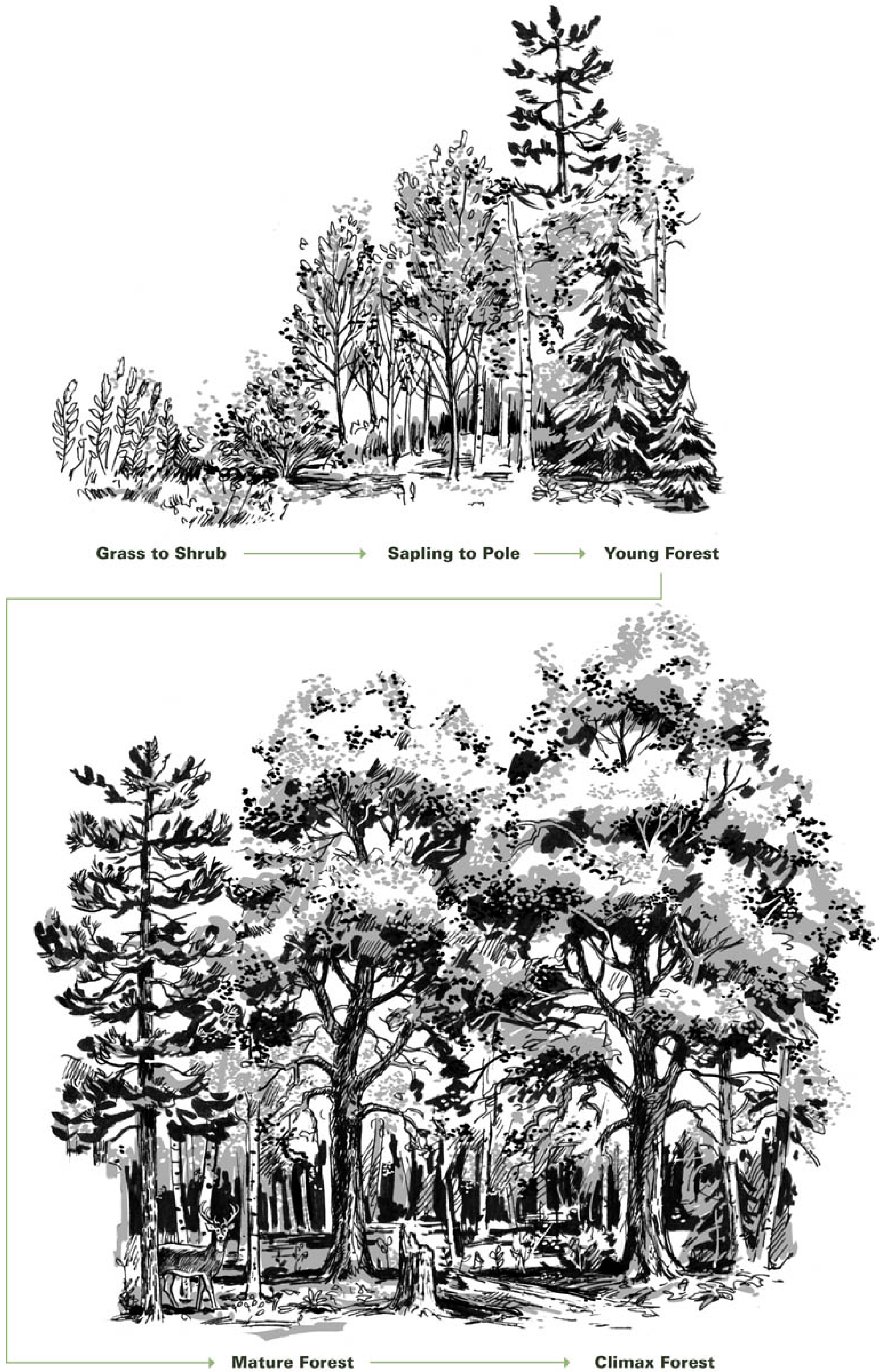
Now that you have a basic understanding of forest structure, composition, and succession, let's consider several successional indicators you're likely to find in your own woodlot. You'll notice that some of these successional events are natural, whereas others are a result of past land-use practices.

Wolf or pasture trees. As you walk your woodlot, do you notice a tree or two that are significantly larger than the rest? Do the branches fork and sprawl in all directions? Do those trees happen to be in or at the edge of what was once a pasture? These trees, called “wolf” or “pasture” trees, were most likely left as shade and shelter trees for livestock. The sprawling crowns mean that these trees had plenty of growing space and were able to stretch unencumbered, both up and out. Their dominant position and lack of competition indicate that these trees are able to thrive, producing copious seed crops. This in turn sets the stage for succession. If the pasture tree is shade intolerant or intermediate in tolerance, such as a white pine, the seeds dispersed by animals and wind will allow for colonization of open pasture, thus beginning the process of forest succession. If the pasture tree is a more shade-tolerant species, such as a sugar maple, the seed crop is more likely to establish in the shade below the parent pasture tree.

Wild apples. As a forester, I receive several calls each year from folks looking to establish a small homestead orchard. Most people just assume that since they haven’t seen any apples in their forest, they don’t have apple trees. And these landowners could be forgiven for thinking this. More than any other tree, apple trees change form when left to nature’s devices. Often, there will be a series of low, dead branches that make the apple tree appear more like a shrub than a tree. These branches are an indicator of browsing, either by livestock (if the area was once pastured) or by wild browsers such as rabbits and deer. The second reason people often miss wild apple trees in their woodlot is that there are no apple flowers or fruits to be found. Apple trees are generally shade intolerant and shift from fruit-producing (reproduction) mode to survival mode once they are shaded. Fortunately, wild apples are highly resilient and will respond well if they are slowly “released” through the removal of the overstory and careful pruning. Reclaiming ancient wild apples trees is much faster than establishing a new orchard; it can also help keep heirloom varieties alive and growing.

THE SUCCESSION PROCESS

Forest succession — from grass to climax forest — is the story of continual competition in response to changing conditions such as light, moisture, and growing space. While the general ecological process is predictable, forest pests, fire, and other natural disasters can set the forest back to an earlier successional stage at any point.


Grass to Shrub
Sapling to Pole
Young Forest
Mature Forest
Climax Forest

Level ground and mounds. As you walk through your woodlot, note the topography of the forest floor. Is it smooth, or does it look more like moguls on a ski slope? If it's relatively smooth, it's likely that the woodlot was once a field or previously clear-cut. In contrast, a bumpy, rolling forest floor is a telltale sign of a previous successional event. Often, these bumpy forest floors occupy wetter sites, or sites with thin soils close to bedrock. While trees need plenty of water, too much water can drown the roots, thereby encouraging the tree to develop roots close to the surface of the soil. The trade-off, of course, is that the tree is not as well anchored. As a result, these trees are likely to blow down, flipping the rootball 90 degrees. Once one tree falls, a gap is created that allows neighboring trees to fall, just like dominos. As these trees begin to decompose, two distinct microenvironments are created. The first is a shallow wet pit once occupied by the rootball; the second is a higher, drier mound that, for many species, is an ideal site to colonize, thanks to ample sunlight and freshly flipped humus mixed with mineral soil. Of course, being high and dry on a mound comes with its own challenges, namely, the need to establish firm roots below! Anchoring requirements are met by growing stilt roots that extend over the side of the rootball. Once mature, these "stilted legs" are sought by many woodland homesteaders as stools or table bases.

Basal scars. As you walk through your woodlot, take time to examine not only the crowns and trunks but also the bases of the trees. Do the bases happen to have triangle-shaped markings? These marks are actually old wounds most likely caused by logging or in some cases wildfires. To determine the cause, note the location of the basal scars. Are they facing one another, or are they randomly distributed throughout the woodlot? Basal scars facing one another are an indication of damage caused when dragging or skidding logs along a trail. This damage is likely to be more dramatic on corner trees that are used as bumpers. Basal scars resulting from fire are likely to occur randomly throughout the woodlot and are generally larger and deeper on the uphill side, where embers smolder in a pocket between the base of the tree and upward-sloping ground. Regardless of cause, the health of these trees is likely to be compromised through their wounds, which serve as an open door to forest pests and disease. Trees that were damaged through logging were often those left behind with poor form or poor health; for the woodland homesteader, removing these trees is an opportunity to improve forest health and fill the woodshed at the same time.

Branch whorls. If your woodlot contains pine species, you have an important clue regarding site productivity. The vertical section between each whorl, or ring of branches, represents a single year's growth. On young trees, this means that you can simply count the whorls to determine the tree's age. On productive sites with adequate sunlight, annual vertical growth can be measured in feet, not inches. On older trees, determining the age based on branch whorls is made more difficult because most pines are "self-pruning." This means that as the canopy grows and closes in, the lower, shaded branches die and eventually fall off. Once the branch is gone, the tree closes up the wound by growing callus tissue. As a tree ages and the bark becomes rougher and more irregular, it can be difficult to determine the location of previous branch whorls. The new wood growth over the former branch site is known as clear wood and is prized by woodworkers for its straight grain.

SIGNS OF SUCCESSION

A: Wolf tree. The wild, sprawling branch pattern is an indication that this tree once occupied a pasture.

B: Wild apple trees. Don't discount trees without fruit or with small fruit; slowly releasing them to more light will encourage fruit production.

C: A bumpy forest floor. A mound and depression side-by-side indicates windthrow (a tree that was uprooted).

D: Basal scars. These can be an indication of mechanical damage from logging or fire.

E: Branch whorls. The space between each whorl on a conifer indicates a single year's growth.

CASE STUDIES

From Woods to Goods

The development of your woodland eye not only will allow you to understand what past event led to current conditions but also will give you the tools to understand how forest structure can be altered to meet a wide range of goals, producing a wide range of goods. The following case studies contrast two woodland homesteads, one small, one large. Along with the homesteader's goals and objectives, we'll examine the goods or outcomes achieved on each property.

The Arnold Homestead

Small Woodlot, Big Results

Beth and Tom Arnold live in a Madison, Wisconsin, suburb on just under 1 acre. The Arnolds' property is mostly wooded, with a small backyard that Beth currently uses as a kitchen garden. The Arnolds' primary goals are to produce more of their own fruit and vegetables, to keep a few laying hens, and to perhaps make maple syrup. In addition to these primary goals, Beth would like to harvest shiitake mushrooms; she loves them and is tired of paying premium prices for them at the supermarket. Tom is an avid woodworker and would like to grow his own materials for projects. After conducting a basic inventory, the Arnolds were able to develop an action plan based on their goals.

Goals

Produce More Fruits & Vegetables

Available Resources & Techniques: A sunny fenceline is ideal for planting dwarf fruit trees, which produce high yields in small spaces.

Outcome: It took five years for the dwarf apple trees to begin bearing fruit. The Arnolds average approximately 5 bushels of fruit annually from their three trees.

Available Resources & Techniques: An inventory of the Arnolds' small woodlot indicates a large number of red oak trees in the 4"–8" pole class, ideal for shiitake mushroom cultivation.

Outcome: In addition to inoculating 48" poles, the Arnolds also inoculated the remaining stumps, producing 30 pounds of mushrooms, which they were able to dehydrate for year-round use.

Available Resources & Techniques: Shade from the forest, house, and fenceline mean that the Arnolds will benefit from planting shade-tolerant fruits and vegetables.

Outcome: In a wet corner of the woodlot, fern-height competition was eliminated to encourage the growth of fiddlehead ferns. The Arnolds harvest 6 pounds of fiddleheads annually, which they blanch and freeze. Rhubarb was transplanted to the forest edge, producing 20 pounds of stalks annually from four plants. Six highbush blueberry plants were planted in the understory of the woodlot, producing 2 gallons of berries annually.

Produce Maple Syrup

Available Resources & Techniques: While dominated by red oak, the property contains 12 sugar maple trees, all over the minimum tapping diameter of 10" DBH

Outcome: The Arnolds averaged 10 gallons of sap per tree, or about 1 quart of syrup per tree, resulting in a total production of 3 gallons, enough for the entire neighborhood.

Keep Laying Hens

Available Resources & Techniques: A portable chicken coop is ideal for the Arnolds. In summer the coop can be moved around the lawn, fertilizing at the same time. In winter the chickens will benefit from moving the coop into the woodlot, which acts as a natural windbreak and also fertilizes and scarifies the forest floor.

Outcome: Six hens averaged five eggs per day in summer; two in winter. Feed was reduced by 25% in summer, as chickens were able to forage for plants and insects.

Produce Woodworking Materials

Available Resources & Techniques: The forest inventory revealed the presence of black-knot disease on several black cherry trees. This renders the trees useless as lumber, but the burls formed by the disease are fine for carving. Tom will release and prune several young white pine trees as a future furniture crop. The knot-free wood is valuable for a variety of woodworking projects.

Outcome: Tom turned the burls into functional, beautiful bowls. The remaining trunk of the tree was sawn into live-edge boards or flitches that can be turned into cutting boards or furniture-grade lumber. Releasing the young pines from competition will double their growth rate. Pruning ensures clear, defect-free wood in the future.

The Tucker Homestead

A Dream to Blend Farm & Forest

The Tucker family of northern Virginia purchased an abandoned 40-acre homestead that was once largely pastureland but over the last half century had been reclaimed as forest. The Tuckers considered cutting the trees and hiring an excavator to remove the stumps and reclaim the pastures. However, this option was less than appealing because it would not only have been cost prohibitive but also would have meant giving up all the benefits the young forest provided, ranging from privacy to recreation and wildlife habitat. Instead, the Tuckers looked to develop a homestead that blends their farm and forest ambitions.Concerns related to both health and sustainability drove the Tuckers to rate home meat production as one of their primary goals. The Tuckers would also like to minimize infrastructure costs and inputs associated with animal husbandry, and to produce 100% of their own heat using firewood from the property, but they are not sure that the land can meet their wood needs in perpetuity. While hardwoods dominate the property, nearly 20% of the land contains pasture pine that has been attacked by the white pine weevil. Finally, the Tuckers would like to rehabilitate an old apple orchard for cider production.

Goals

Livestock Production (Meat)

Available Resources & Techniques: Reduce basal area to 20 square feet/acre, leaving crop trees in silvopastures; use pigs in portable pig tractor to excavate stumps; and use feed seeding techniques to establish pasture.

Outcome: The Tuckers created silvopastures by keeping the best trees as crop trees for forage, shade, and eventually lumber. The UGS were removed for firewood. For more information, see **Awesome AGS**.

Livestock Production (Dairy)

Available Resources & Techniques: Select large-crowned crop trees to provide shade for dairy animals, and use portable fences to allow cows and goats to glean drops in the orchard area.

Outcome: Large sugar maple trees were retained not only to create shade but also to preserve the option of the Tuckers developing a sugarbush in the future. Moving cows and goats through the orchard area was an effective way to make use of drops. Once drops have been consumed, it is important to move animals to fresh ground to avoid damage to fruit trees. For more information on grazing your woodland orchard, see **chapter 3**.

Minimize Animal Husbandry Infrastructure Costs

Available Resources & Techniques: Conifer areas should be left as a living barn; existing trees will form a living fence.

Outcome: The living barn averaged 8°F warmer in winter while offering adequate ventilation. The living fence system saved nearly $1,000 over a conventional fencing system. For more information, see **chapter 5**.

Sustainably Produce 100% Of Firewood Needs

Available Resources & Techniques: An inventory of the property determined that the forest can currently only provide 80% of the Tuckers' firewood needs; employ stand improvement and coppice methods to increase firewood production.

Outcome: Intense competition among trees meant that few trees thrived. Thinning and other stand improvement activities increased productivity. Species capable of coppice reproduction were selected throughout the woodlot. For more information, see **chapter 4**.

Find Use For Pasture Pine

Available Resources & Techniques: The stout, branchy form means that only half logs (8') can be cut from these trees. The tops, however, may be inverted and used as tables, stools, and chairs.

Outcome: The smaller logs were easier to skid using the Tuckers' draft horse, Lady. A neighbor offered to saw the logs on a portable sawmill in exchange for 50% of the lumber. The weeviled tops were used, sold, and traded as rustic furniture. For more information, see **chapter 4**.

Rehabilitate Abandoned Apple Orchard

Available Resources & Techniques: Wild vines, an encroaching overstory, and competing shrubs all prevented this orchard from producing fruit.

Outcome: Releasing the trees through the removal of competition over a two-year period restored the productivity of the orchard. The trees now produce, on average, 5 bushels per tree per year. For more information, see **chapter 6**.

CHAPTER 2

Tools and Techniques

Essentials for the Homestead Woodlot

Now that you've inventoried your homestead woodlot and begun to sharpen your woodland eye, it's time to start learning the tools and techniques that will make your land more productive, sustainable, and enjoyable. Because homestead woodlots vary in size from a fraction of an acre to several dozen acres, we'll examine tools and techniques for a variety of projects and properties at different scales. We'll begin by turning our eye to the past, to learn about woodland hand tools and techniques that have been largely forgotten but are useful to homesteaders because they are simple, are readily available, and have stood the test of time.

HOMESTEAD TASKS, TOOLS & TIPS

Task	Tool	Tips
Splitting firewood	Splitting axe or maul	For lighter splitting work, use an axe. For tough, knotty wood, a maul (heavier than an axe) is often preferable.
Chopping wood	Felling axe	Select an old axe without major chips in the bit. Don't be deterred by rust or a broken handle; those are easy to fix.
Hewing a log	Hewing axe, adze	Choke up on the axe handle for more control. For a smooth finish, end the job with a razor-sharp adze.
Making shakes	Froe	Never use a metal hammer to pound the froe; a wooden mallet is all that's needed to split shakes.
Moving a log	Arch, stone boat, go-devil, or winch	Regardless of the tool you use, be sure to avoid rubbing up against other trees when you skid; damaging your residual crop can compromise the health of your woodlot.
Pruning trees	Pruning shears, loppers, pruning saw	Use pruning shears for branches up to ½ inch in diameter, use loppers for branches up to 1 inch in diameter, and use a pruning saw for anything wider than 1 inch.
Harvesting fruit	Orchard ladders and fruit pickers	For standard-size fruit trees, you'll want a sturdy three-leg orchard ladder. If you prefer working from the ground, consider a fruit picker, which is a pronged wire basket attached to a pole. Place the basket under the fruit and twist the pole to release the fruit.
Making basket splints	2-pound maul	Traditionally, logs were pounded with a wooden mallet to separate the growth rings of a log for basket splints. Using a 2-pound maul will separate the rings faster, speeding up the process.
Peeling fenceposts	Drawshave	Since bark holds moisture, it's best to peel your fenceposts before burying them in the ground. Cut the posts in early spring when the sap's running, and the bark will peel easily with a drawknife or even a putty knife.
Tapping trees	Brace and bit	Maple trees were traditionally tapped using a hand brace, which is a common find at tag sales. Lean on the end of the brace as you drill your taphole, and remember to maintain a slight upward angle. If you have lots of trees to tap, consider using a cordless lithium-ion drill (but be sure to bring along extra batteries).

THE AXE

No other tool has shaped the American landscape as drastically or indelibly as the axe. What began as a stone lashed with sinew to a wooden handle during the Neolithic period eventually evolved, over a 10,000-year period, into the modern steel axe. The first metal axes were cast of copper, which could be filed to a sharper edge than most stones but unfortunately was too soft for all but the most delicate of tasks. Around 3000 BCE, copper was combined with tin to form bronze, which was both a durable and workable material. The early bronze axes were both utilitarian and war implements that remained largely unchanged for nearly a thousand years. Around 1300 BCE, iron ore mining led to the proliferation of inexpensive iron axes, which the Romans eventually improved on by adding carbon to create steel.

As steel became the chosen material for virtually any durable good, European axe makers began saving steel for just the bit, or cutting edge, of the axe and used cheaper iron for the cheeks and poll (the back) of the axe. Prior to the mid-19th century, European blacksmiths produced two types of axes: broadaxes for making square timbers (also called “cants”) and lighter-weight general-purpose axes that were used for a variety of farm and woodlot chores.

THE EUROPEAN AXE COMES TO NORTH AMERICA

When European settlers arrived in the virgin forests of eastern North America, they quickly discovered that the smaller, lighter-weight European axes that were used on small-diameter coppiced trees weren't up to the task of felling large timber. These early settlers made two modifications that resulted in the modern felling axe.

A heavier poll. First, the settlers added substantial weight to the poll of the axe. This additional weight meant that the woodsman didn't have to swing as hard and could instead let the weight of the axe do the work. More weight behind the handle also meant better balance, which made for truer swings.

A shorter bit. The settlers also shortened the bit, or cutting edge. Early European axes had a wide cutting edge, which made for an effective battle weapon but didn't allow for concentrated penetration when it came to chopping wood.

Felling axes also developed regional identities as blacksmiths and lumberjacks named their axes after the places they were made; Connecticut, Michigan, Maine, and Pennsylvania were all popular patterns. As they replaced the blacksmith, modern forges began to produce hundreds of patterns for different uses and enough pattern choices to satisfy lumberjacks from coast to coast. In fact, by the early 19th century, more than 300 patterns existed for felling axes alone.

THE DOUBLE-BIT AXE

A variation of the single-bit felling axe was the double-bit axe, sometimes referred to as a "reversible." These axes first appeared in Pennsylvania around 1850 and were commonly used in the Northeast by 1860. The debate continues as to whether a single-bit or double-bit axe is superior. Single-bit aficionados point to the fact that this axe benefits from a heavy poll, which allows the axe to penetrate deep into the wood. Those who prefer the double-bit axe point to its utilitarian benefit: one bit can be kept stoutly sharpened for cutting knots and dirty wood, while the other can be finely honed for cutting clear and clean wood. In the end, it's likely a matter of personal preference, with the single-bit axe being a more efficient tool and the double-bit axe having greater versatility.

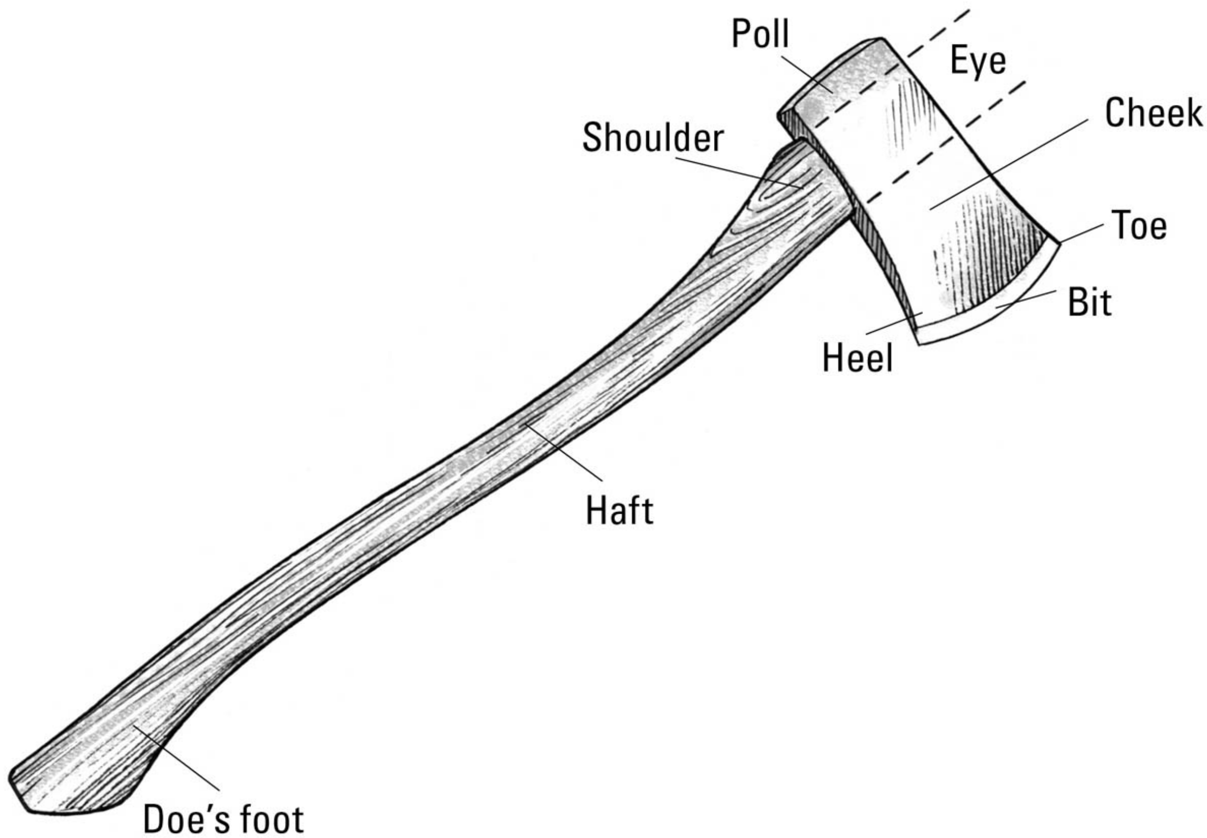
CHOOSING AN AXE THAT FITS YOUR NEEDS

Axes come in a variety of shapes and sizes to suit a range of tasks and users. The smallest member of the axe family is the trusty hatchet. Its small size makes it easy to stow and carry, while the short handle affords control. However, since the size of the axe is roughly proportional to the size of the job, you'll find the hatchet most appropriate for light chores like splitting kindling. A step up from the hatchet is a "boy's axe," which typically has a mid-length handle (about 28 inches) and a 2- to 2½-pound head, making it ideal for a variety of woodlot chores. The full-size felling axe typically has a long handle (31 to 36 inches) and a heavy head (3 1⁄2 to 6 pounds) but is capable of handling larger jobs on the woodland homestead.

FROM RUSTY TO TRUSTY: RESTORING AN OLD AXE

Seeking out old axes and restoring them is well worth your time. It is estimated that from 1850 to 1950 more than 10 million felling axes were produced by more than 100 different axe manufacturers. During this period, manufacturers had easy access to quality steel, and competition among forges meant that the quality of axes produced remains unprecedented to this day. Relatively few high-quality felling axes are still made, but barns and basements continue to be great places to find a quality vintage axe just begging for a second chance.

ANATOMY OF AN AXE



FINDING THE AXE

Finding a vintage axe to restore is easy if you know what to look for. First, don't get hung up on the state of the handle. In most cases, the old handle will be brittle, cracked, or rotted near the eye. Instead, focus your search on finding a salvageable axe head. Consider how you'll use this axe: Will it be for felling large trees? Maintaining trails? Or splitting firewood rather than chopping wood (cutting diagonally across the grain)? If your goal is to have an axe for splitting, even the most chipped and abused axe can be resurrected as a trusty splitter. If, however, you want a chopping axe with a keen edge, find an axe with a gentler past and perform the all-important five-point axe inspection.

Five-Point Axe Inspection

Size. A standard felling axe weighs 3½ pounds. A longer, thinner-bitted axe will slice through wood more easily, while a short, chunky axe is better suited for splitting, where you're not actually cutting the wood but simply "popping" the wood apart along the grain.

Markings. Virtually all quality vintage axe manufacturers included their name or logo on the cheek of the axe. Some of the more notable axe makers were Plumb, Kelly-True Temper, Mann, Collins, and Council. All of these companies used quality steel in their axes. In some cases the markings can be difficult to locate, though a bit of steel wool will usually reveal a clear enough stamp to identify the maker. As you search barn sales and basements for vintage axes, keep an eye out for the rare and highly coveted Kelly-True Temper Black Raven. This axe was sought not only for its superior steel quality but also for the intricate black raven stamp on the side. In good condition, this axe can fetch several hundred dollars.

Bit condition. The bit of the axe is where the work is done, so it is important that the bit is relatively free of chips. A chipped bit will create resistance, known as drag, when you try to chop. Therefore, it becomes necessary to grind the bit until the chip is gone. The problem is that grinding the axe creates a shorter, stouter bit that doesn't cut very well. You'll also want to inspect the toe of the axe; it should carry the same arc as the rest of the bit. If it’s rounded off, that’s a telltale sign that the axe has been used for cutting roots or maybe even sharpening rocks. This is problematic because an overly rounded bit coming in contact with a round log increases the odds of the axe glancing, or deflecting in an unsafe direction as the two rounded surfaces make contact.

Eye condition. The eye is the only point of contact between the handle and the head of the axe. An eye that is even slightly out of plumb means that the axe will never swing true, creating just enough deviation in the swing that the axe will likely glance, and potentially score a date with your shin. There are two potential causes for an untrue eye. The first is a defect in the manufacturing process. When an axe is made, the eye is generally cut using a punch. If the punch is not perfectly aligned, an off-center eye will result. The second is a result of misusing the axe as a sledgehammer. Because the steel on the sides of the eye needs to be thin to achieve a narrow profile, it is particularly susceptible to bending and warping. This deformation often prevents the handle from fitting properly. It’s best to avoid any axe that shows an off-center or deformed eye.

Poll condition. The poll is located directly behind the eye of the axe and is commonly “mushroomed” as a result of the axe being used as a sledgehammer. In cases of minimal damage, the burred edges can be lightly ground. In other cases, hairline cracks may extend from the eye into the poll or the eye may be deformed, as described in the preceding paragraph. As a general rule, axes with severe mushrooming and cracks should be avoided.

ABOVE: *An axe drift is used to remove the handle from the eye. If you don't have a metal drift, make one by cutting a short section out of the broken handle.*

A NEW HAFT FOR YOUR OLD AXE

If your old haft, or handle, shows any signs of deterioration (cracks, a loose head, or a rotted eye), you should begin your restoration by fitting a new handle that you can safely clamp in a vise when you need to sharpen the head of the axe later on. “Hanging an axe,” as woodsmen often call the process of fitting a handle, is as much of a skill as swinging or sharpening an axe; it requires both patience and practice.

Removing the Old Haft

Before you hang a new haft, you’ll likely have to remove the old one. A common temptation is to toss the head in the fire to burn out the eye. Do *not* do this. Doing so will change the temper of your axe, in most cases making it more brittle and prone to cracking. Instead, saw off the old haft and remove it from the top down. This can be accomplished one of two ways:

- If the wooden wedges in the top of the handle are dry and brittle, you may be able to pry them out with a screwdriver or chisel. Once you’ve removed the wedges, you can then drive the handle out the bottom of the head using an axe drift (simply a block of wood or steel that is slightly smaller than the eye of the axe). Place the axe head in a vise or between two wooden blocks, and hammer the drift until the handle pops.
- In some cases, you won’t be able to remove the wedges, which makes removing the eye of the handle nearly impossible. In this instance, you can use a drill to remove

enough wood so that the plug can be popped out. Drilling from both the top and the bottom of the head makes this process go faster.

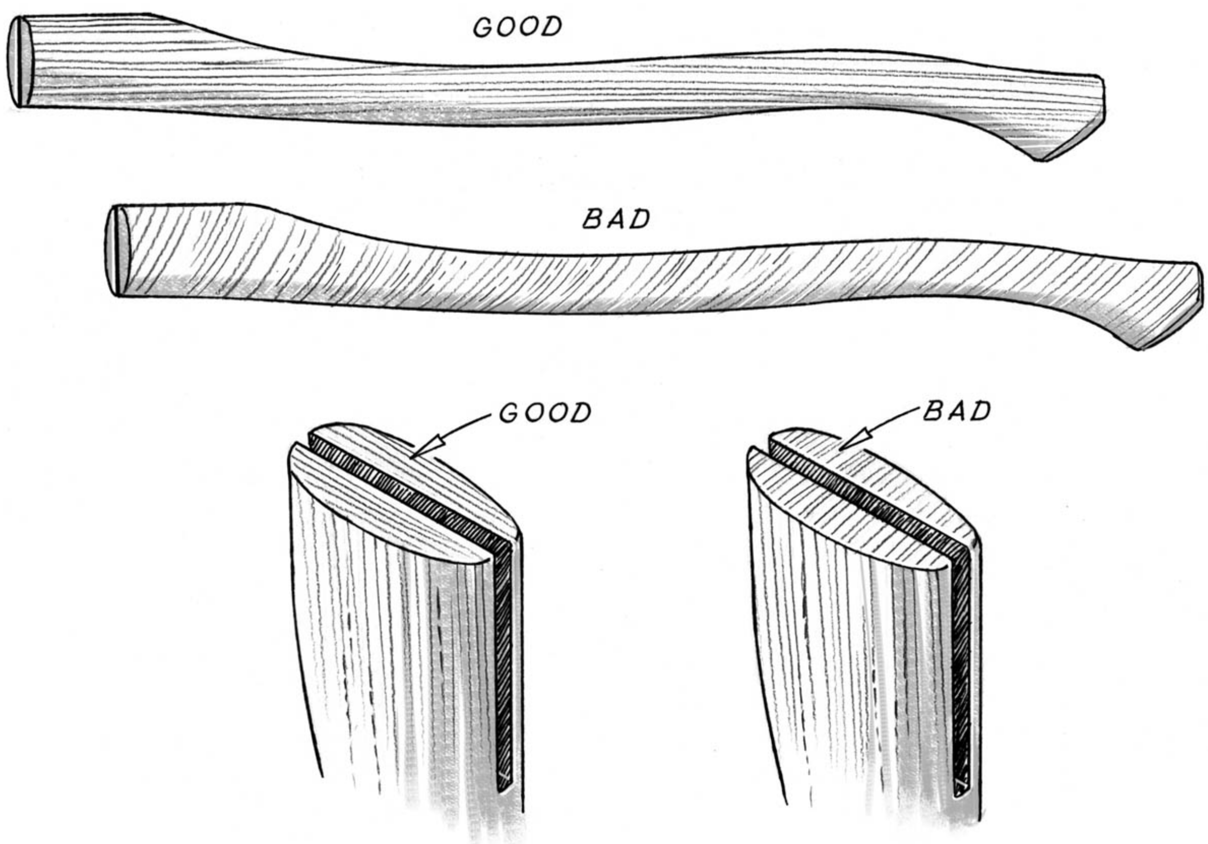
Selecting a New Haft

Once you've removed the old haft, it's time to select a replacement. Three considerations should guide your selection of a new handle: straightness, grain orientation, and growth-ring width.

Straightness. Handles are generally sawn out of hickory or ash logs and then turned on a lathe. Depending on where the tree grew and how the log was sawn, the handle may twist or bow. With the exception of broadaxes, which have intentionally curved handles, you'll want to examine your replacement handle for trueness. By holding the eye of the handle just below your eye, visualize an imaginary line from end to end. Does the handle hold true to that line, or does it bow either left or right, or twist? Only accept an axe handle that is straight and true. Using a twisted or curved handle can cause the axe to glance, causing injury.

Grain orientation. The end of the axe handle is known as the doe's foot and will tell you which way the grain runs. Ideally, the grain should run parallel to the bit of the axe. Handles in which the grain runs perpendicular to the bit are inherently weak and snap under percussion.

Growth-ring width and quality. Tight, narrow rings indicate slower growing wood, which makes for a stronger handle. You should also pay attention to the color of the wood: Is one side of the handle dark wood and the other side light wood? The dark wood represents heartwood, which is dense but brittle. The lighter wood is the more recently grown sapwood, which is strong and flexible. Try to select an axe handle that is made entirely of sapwood. A handle that is made of both sapwood and heartwood is more likely to fracture.



ABOVE: *Taking the time to select a haft with proper grain orientation will reward you with years of service. The grain should always run parallel to the bit of the axe.*

Getting the Hang of It

The expression "to get the hang of it" originated with lumberjacks who were referring to a proper union between haft and head. If a haft fit poorly, the jack would often proclaim, "I just can't get the hang of it," meaning "I just can't get it right."

RESTORING THE AXE HEAD

By beginning your axe restoration with a new handle, you now have a dependable point from which you clamp, hold, and work on your axe. To preserve your new handle, clamp it in a bench vise using a shop rag. The middle third of the handle is the straightest part, giving you the best clamping location.

Remove the Rust

You'll want to begin by removing the surface rust, which can be done by hand with a sanding block but is much more effective using either a belt sander or an orbital sander. If your axe looks more like a relic from a shipwreck than a trusty tool, consider starting with 80-grit sandpaper. Start lightly, keeping an eye out for manufacturing marks. If you find any, lightly sand these areas by hand using steel wool.

After removing the surface rust, you'll have a better idea what you're dealing with. Deeply pitted axes may prove unserviceable, though in most cases these axes may be resurrected by using a more aggressive grit of sandpaper and additional elbow grease. Cleaning up the cheeks of the axe is important because this is the part of the axe that is in greatest contact with the kerf (or cut surface) of the log. Any pitting or remaining rust will serve as an abrasive, making the axe stick.

Once you've removed the majority of the rust with 80-grit sandpaper, move to 120-grit sandpaper. As you continue to clean the axe, maintain light pressure and make sure you don't allow the sander to catch the bit. Also, if you're using an orbital sander, make sure it's continually moving; you don't want to create "hills" or "valleys" in the surface of the axe. With a belt sander, this is easier to avoid since you have a large, flat plane that you're essentially laying on the cheek of the axe.

Once you've cleaned up the surface of the axe, you can then restore the back, or poll, to its original form. If the axe was ever used as a hammer, the poll will likely be in need of some light grinding to remove burrs and mushroomed edges. With the axe laid flat in the vise, make long, smooth strokes to clean up the mushroomed poll. You may also find that the top edge of the axe needs light grinding as well; this is often the result of using a hammer, instead of a wood or rubber mallet, to drive out an old handle. Take your time and remove as little metal as possible.

CRAFTING A KEEN EDGE

Ask two woodsmen how to sharpen an axe, and you're liable to get three answers. Some swear by a filed edge, while others believe in only using a whetstone. Still others use bench grinders or belt sanders. My experience is that the condition of the bit and the quality of the steel are the two factors that ultimately determine which tool I use for sharpening.

Sharpening with a Belt Grinder

If the bit of your axe is in poor condition, with chips, gouges, and other imperfections, I would strongly recommend using the belt grinder method outlined in this section. Do *not* use an angle grinder for sharpening the edge of your axe. The wheel of an angle grinder is too small to create a smooth, even bit. Instead, you'll end up with a bit that is thick in some places and thin in others. What's more, the heat created by grinders can result in hot spots that ruin the temper of the axe. A more effective tool for sharpening dull and damaged axes is a narrow-gauge (1⅛" × 21") **belt sander**.

To begin, use 180-grit sandpaper belts. Before you even plug the sander in, practice drawing the sander back and forth, following the radius of the axe. The sander should point toward the poll of the axe as you do this, and be angled upward at approximately 20 to 25 degrees.

> *"Give me six hours to chop down a tree and I will spend the first four sharpening the axe."*
>
> — ABRAHAM LINCOLN

Once you're comfortable with the motion, you can begin grinding by using light strokes. Be sure to count the number of strokes so that you maintain an even bit angle on both sides. Check the bit regularly to make sure it's not too hot. If it's too hot to touch, you're either going too fast or applying too much pressure.

As you flip the axe from side to side, use a small piece of hardwood to drive off the metal burr that forms as the bit of the axe is thinned to an apex. If you don't drive the burr off, you'll end up with a brittle wire edge that will break off. Once you've removed the major imperfections in the axe, switch to 220-grit sandpaper belts. When the bit is free of nicks and imperfections, you're ready to hone the axe using a whetstone.

Sharpening with a Bastard File

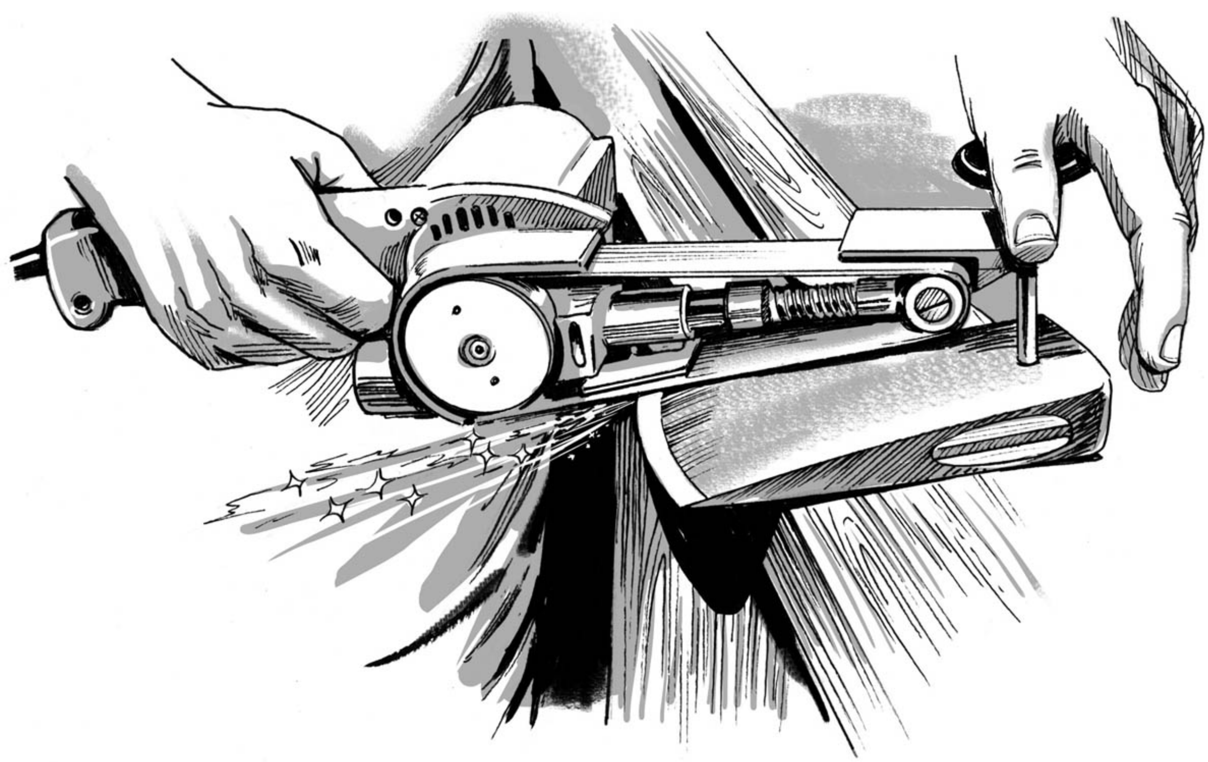
An alternative to the belt sander method is the single-cut bastard file, which I prefer for axes with soft steel or only minor dings. The file can be used freehand or with a jig. The jig maintains a constant 20-degree angle at all times. (See **here**.)

Honing with a Whetstone

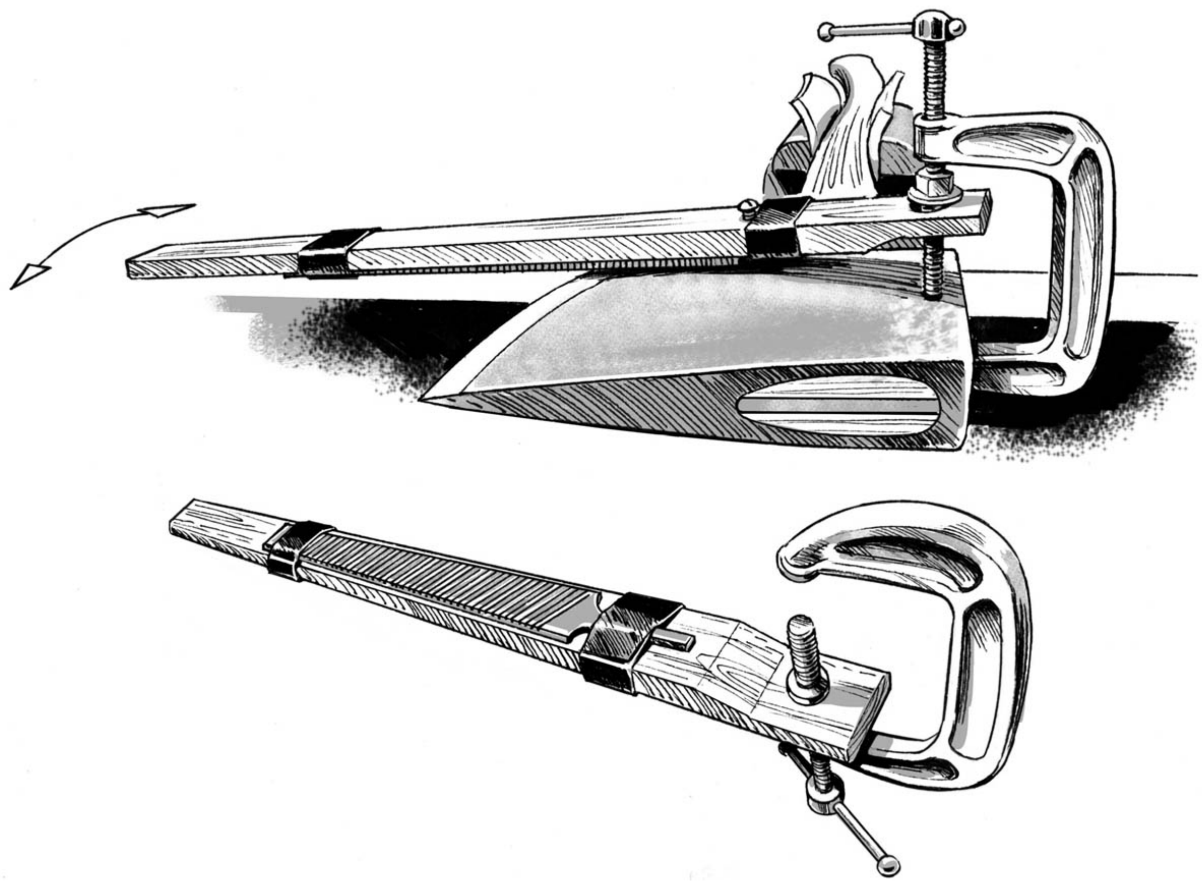
The last step in sharpening the axe is to use a **whetstone** on the cutting edge. This final cutting edge is about 10 degrees stouter than the grinding or filing angle. You can use either a hard Arkansas stone or a long-lasting but expensive diamond stone. As with grinding and filing, it is important to maintain a constant angle; for that reason I prefer long, even strokes over small circular strokes. Be sure to do an equal number of strokes on each side and, as in the grinding process, drive off the burr with a piece of clean hardwood.

A sharp axe will be able to shave the hair on your arm or cleanly slice a sheet of paper. Sharpening an axe with finesse takes time and patience, but the investment pays dividends in the woodlot.

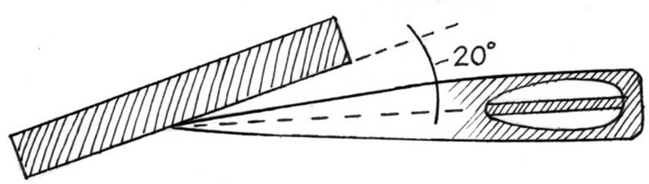
Narrow belt grinder. If done properly, using a belt grinder is the fastest and most accurate way to sharpen an axe. Be sure to mark the center of the arc on the poll of the axe and use a punch to create a small divot. This will create a reference point for sharpening in the future. Remember to count the number of strokes on each side in order to maintain a balanced edge.



Bastard file jig. This simple jig is made from a C-clamp, part of an old yardstick, and a bastard file. The angle can be measured using a compass, and can be adjusted by adding or subtracting metal washers on the C-clamp. A 20-degree angle is ideal for chopping most wood.



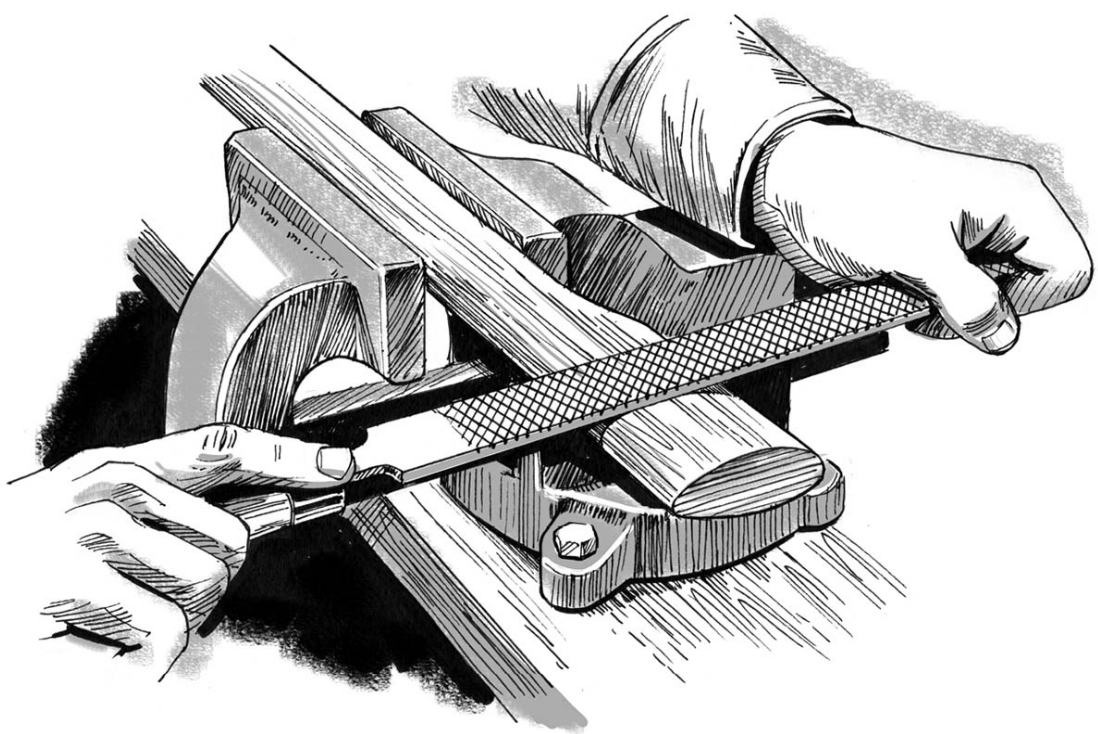
Whetstone. Honing the axe is the final step in sharpening. Use long, even strokes from heel to toe. For a more durable final edge, you can increase the honing angle up to 30 degrees.


HONING
OIL

20°

Hanging the Haft
in 5 Steps

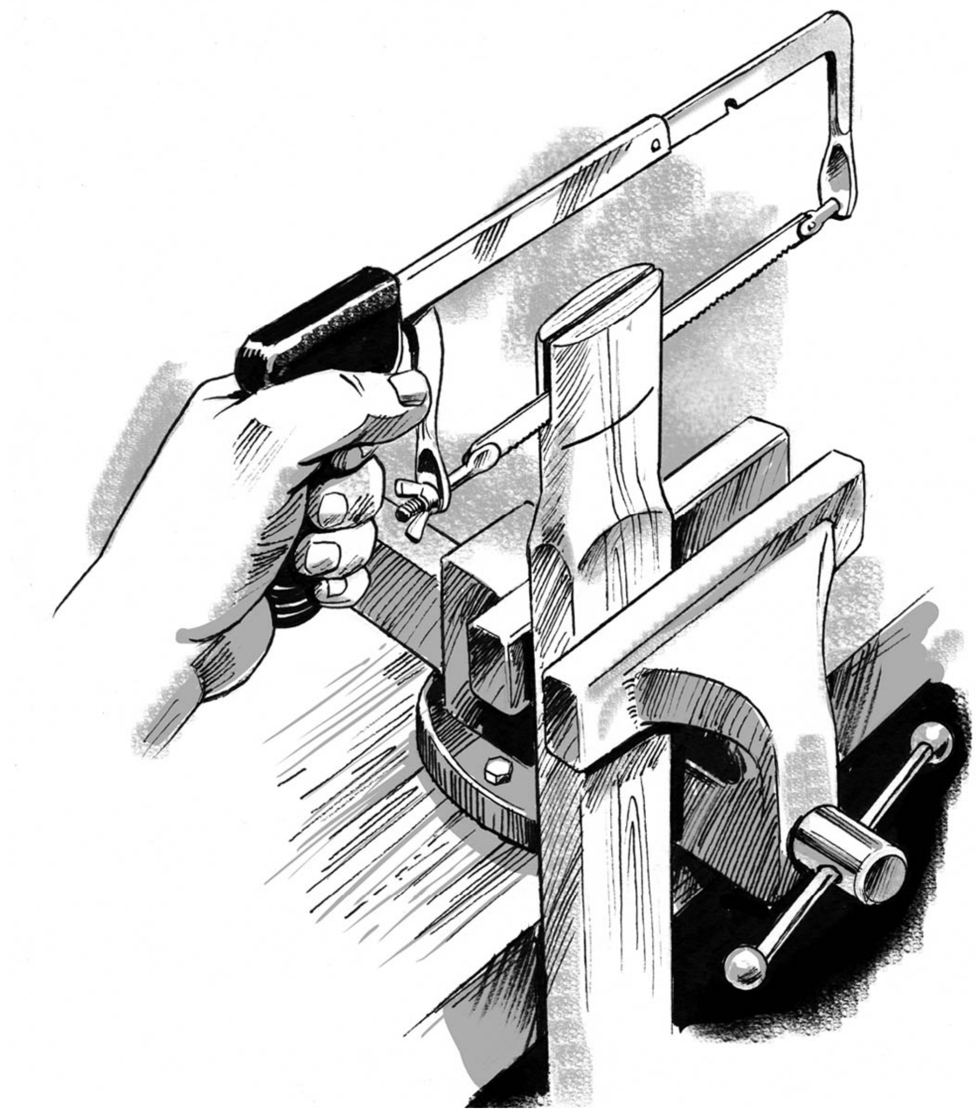
Instructions

1. File the eye of the handle with a rasp until the axe head fits on the shoulder of the handle. Aligning your eye with the axe head, look down the handle and check for trueness. You may have to fine-tune the fit to get it to hang perfectly straight, but this is time well spent.



2. Mark the head location with a pencil and extend the wedge slit with a thin-bladed handsaw, if necessary. The slit

should extend to within 1⁄2 inch of the bottom of the axe head. Cut off any excess handle above the axe head.



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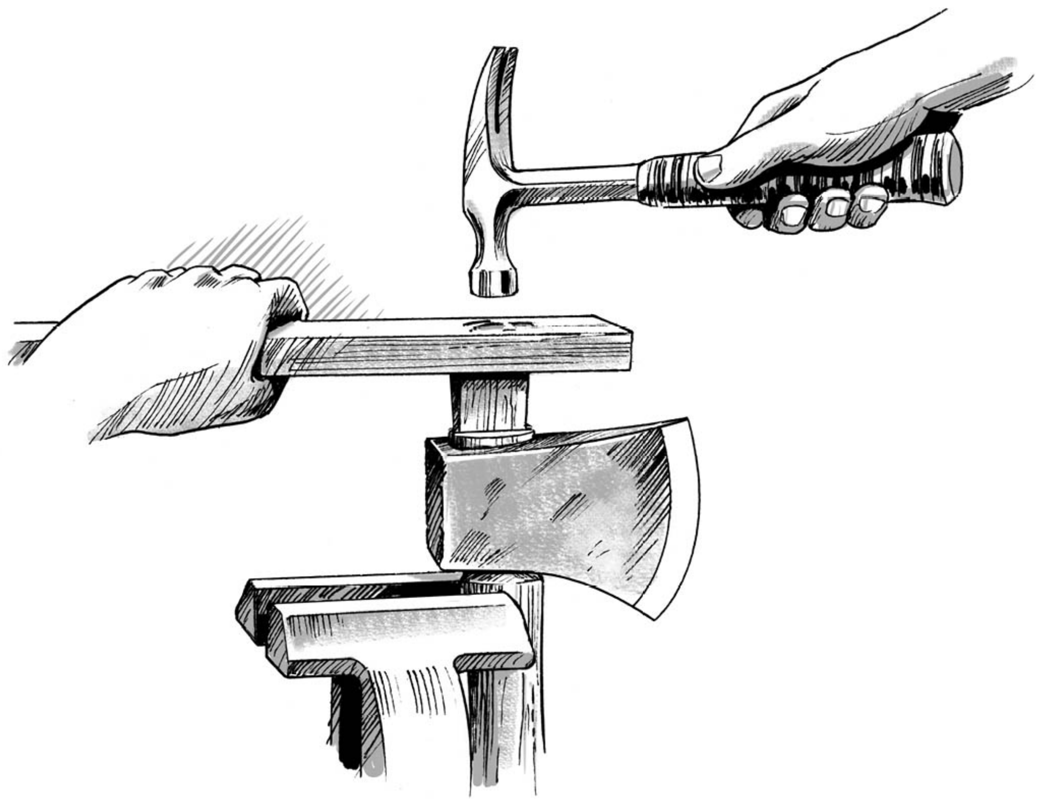
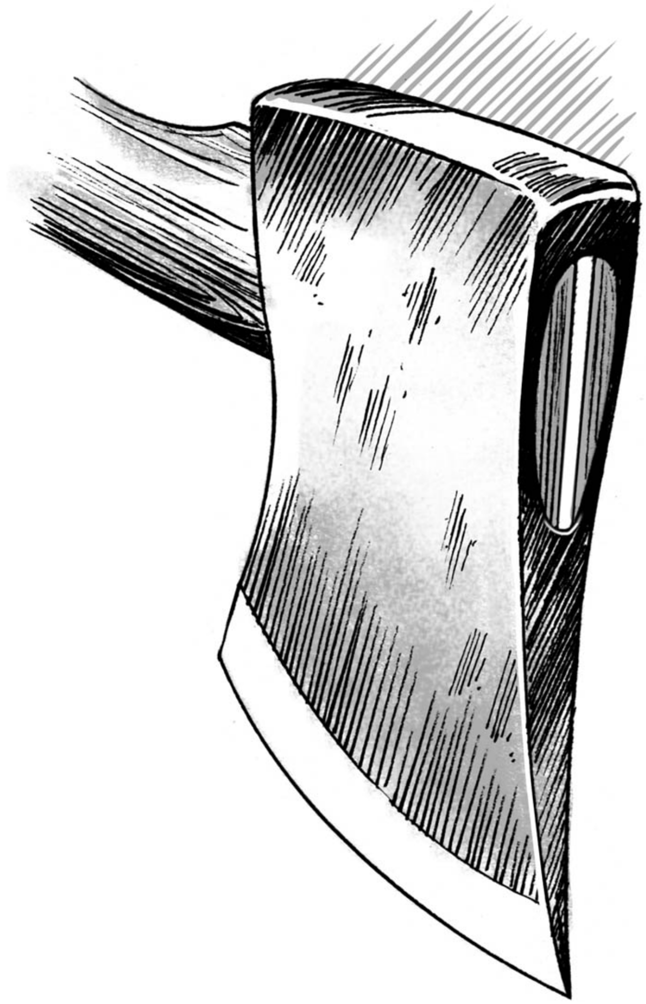
3. Slide the axe handle into the head and use a rubber or wooden mallet to pound the doe's foot. This will drive the head onto the handle.

4. When you're happy with the hang of the axe, drive the wooden wedge in with your mallet. Saw off the top of the seated wedge with a coping saw.



5. If your new handle is untreated, rub linseed oil into it. This will help prevent it from becoming brittle and/or cracked. If the new handle is varnished, consider using medium-grit sandpaper to remove the varnish, and then treat the wood with linseed oil. Varnish can make for an impossibly slick axe handle in wet conditions.



FELLING AND CHOPPING

To early homesteaders, the axe was not just a symbol of freedom; it was a 5-pound ticket to self-sufficiency. Proficiency with an axe meant being able to fell timber to build a home, chop wood for the hearth, and clear land for pastures. And while your axe ambitions may not be as driven by necessity as they were for early homesteaders, there is value in knowing how to swing this basic yet endlessly useful tool. We'll cover the two most common chopping methods used for felling and bucking on your woodlot.

FELLING WITH AN AXE

Referred to today as the standing block chop or vertical chop, this technique predates the advent of the felling crosscut saw, which was developed in the 1880s. However implicit, it is worth noting that felling a tree with an axe is inherently dangerous. Later in this chapter, we'll review felling with a chainsaw, which offers greater efficiency and control. Despite the advantages of the chainsaw, the axe has earned its role in the woodlot as an invaluable tool.

To fell a tree with an axe requires lessons in physics and geometry. First, the physics: Your axe handle is a giant lever connected to a blade. The longer the swing of the stroke, the greater the power delivered to the trunk of the tree. However, power without proper presentation of the axe bit will result in a dull and unimpressive thud. Therefore, axemanship is as much about presenting the axe at the proper angle as it is about developing power. When you begin chopping, focus on accuracy and precision; power can be developed in time.

The shortest distance through a log is perpendicular to the grain. Unfortunately, unlike a saw, an axe doesn't tear grain; instead, it slices the grain at an angle. So, while a shallow angle would result in cutting the shortest distance, it wouldn't be efficient since each hit would achieve only minimal penetration. In contrast, if you chop at too wide an angle, you have to cut a greater distance, reducing your overall efficiency. For most species of wood, you should create an upward 45-degree angle and a downward 45-degree angle, resulting in a 90-degree face that is approximately equal to the diameter of the tree in width.

When felling a tree, make sure you're wearing a hard hat, as well as eye, foot, and shin protection. (See **here** for more information.)

THE SEVEN-STEP SWING

In Motion

Begin all felling by identifying hazards, tree lean, and your escape route. (The section on chainsaw felling beginning **here** gives details on determining each of these.)

Mark out your opening face on the front of the tree. Your bottom hit will be at knuckle height when you stand beside the tree, arms hanging at your side; the location of the top hit should be equal to the diameter of the tree measured from the bottom hit.

If you are right-handed, take a wide stance with your left foot in front, about 18 inches from the tree. Then bring the axe back in line with your right foot. (Reverse this for lefties.) For your bottom hit, allow your top hand to slide down the axe handle as you strike the tree. The striking angle should be 45 degrees.

For your top hit, bring the axe up and away from your body at a 45-degree angle. Allow your top hand to slide down the handle as you strike your top mark.

Work in a clockwise direction, spanning the axe so that you cut both your near and far wood on larger trees. The V angle formed by the cut should close just shy of the midpoint of the tree.

Move to the backside of the tree, working the same diameter scarf and same pattern approximately 1 inch above the front cut. Be careful not to cut through the hinge, as this allows the tree to fall in a controlled manner.

LIMBING WITH AN AXE

Once your tree is on the ground, you'll have a mess of limbs to contend with. The temptation is to cut into the V of the branches, swinging the axe toward the base of the tree. This method causes the axe to dive into the knot rather than cleanly slicing the branch even with the trunk of the tree. Instead, swing from the base toward the top of the tree. Work side to side, limbing the branches while you safely stand on the opposite side of the tree. Make sure that the path of the axe is clear of any branches or other obstructions that could deflect the axe. For larger limbs use a 45-degree V notch to chop through the branch.

ABOVE: *When limbing with an axe, stand on the opposite side of the log to protect your shins from a glancing blow of the axe.*

BUCKING WITH AN AXE

To "buck" a log means to cut it into shorter, more manageable lengths. Historically, lumberjacks would stand atop the tree and swing the axe between their feet to sever the log. As you can imagine, this underhand chop method led to a plethora of lumberjacks earning the nickname “Stumpy.” For most woodlot bucking needs, it’s safer and more efficient to have both feet firmly planted on the ground. (See **Bucking Like a Beaver**.)

You can use a felling axe for bucking; however, it is important to exercise caution since you'll be swinging the axe closer to the ground. Striking rocks on the ground can not only damage your axe but also send chips toward your face. Safety glasses are recommended.

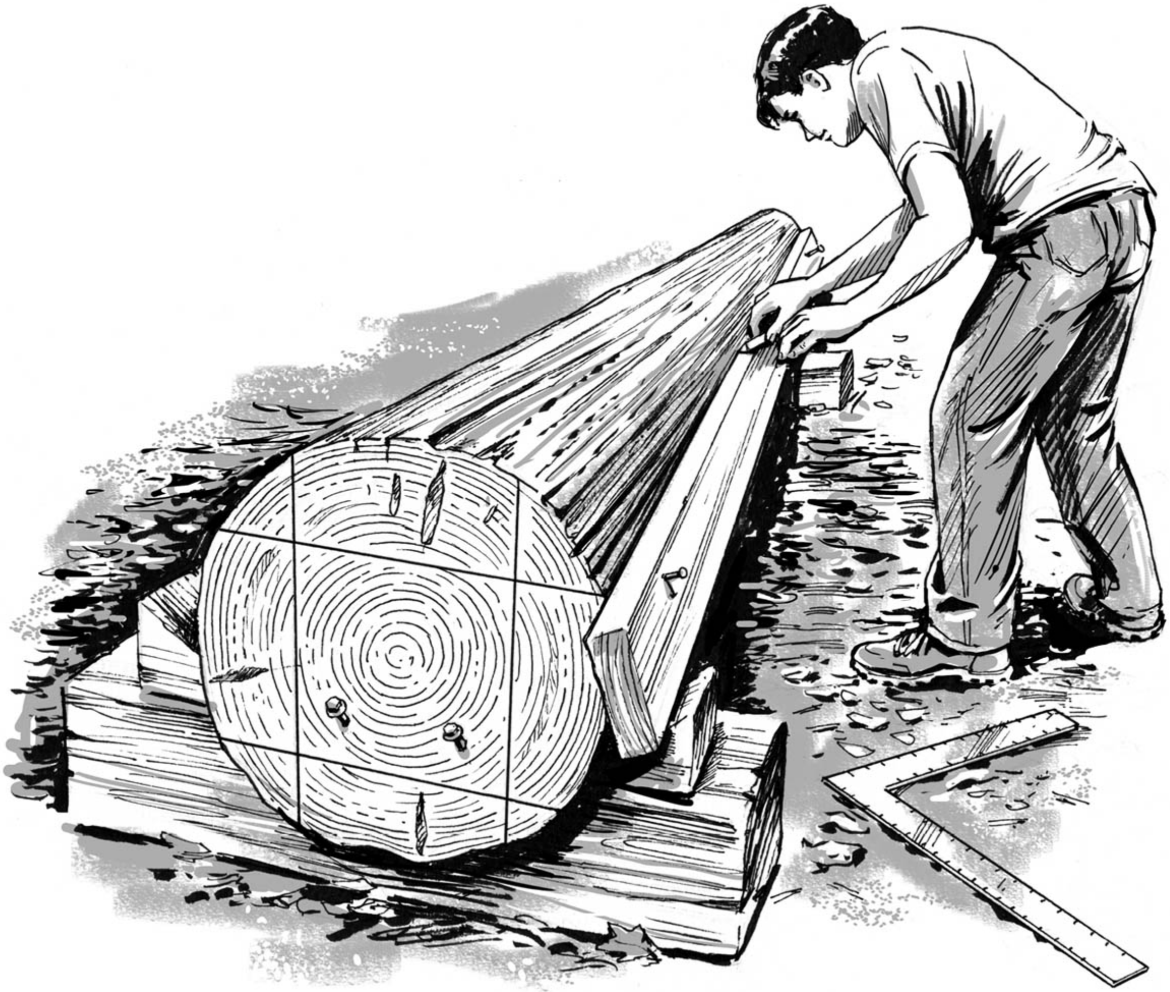
HEWING WITH A BROADAXE

Unlike the felling axe, the broadaxe, or hewing axe, remained relatively unchanged after its arrival in the New World. The purpose of the broadaxe is to square timbers by slabbing off the rounded edges of the log, a process known as hewing. In reality, the broadaxe is a large chisel. Most broadaxes carry a single-bevel bit that's filed to a razor edge. In order to give the hewer control, broadaxes typically have a short handle, no longer than 24 inches.

Once you've selected a straight and relatively knot-free log, you'll want to roll it on to a set of bunks or shorter logs placed perpendicular to the hewing log. These bunks act like sawhorses, giving you a slightly elevated and stable surface to work from. The bunk logs can either be notched with an axe to cradle the log, or held down with a pair of log dogs (giant staples) that are pounded into the hewing log and the bunk log, preventing it from moving. Alternatively, long (8- to 12- inch) lag screws can be set in the end of the hewing log and screwed to the bunk log below.

Once your log is mounted, begin by marking out a square on each end of the log and snapping a line covered in charcoal ash along the length of the log. If you’re working alone, you can tie the string to a nail that you tap in to the corner of your square and pull taut while lining up the string with the corner at the opposite end. An alternative method uses a straight board to connect the lines of the square. This line serves as a depth gauge for a series of shallow notches, or juggles, cut approximately 1 foot apart. Once the juggles are cut, the hewer uses the broadaxe to remove large, dinner-plate-size slabs from the side of the log. This same process is repeated on the opposite side.

If the hewn timbers are for a barn, they can be left rough. If the timbers are to be used in a house, they can be further refined using an adze. The adze looks a bit like a hoe, with a long, square-headed handle and straight cutting edge that’s beveled toward the handle. By standing atop the hewn log and swinging the adze toward yourself, you’ll be able to slice paper-thin sheets of wood that leave the timber perfectly smooth. To protect your feet in this process, rock back on your heels so that the adze runs under your foot, and not into your toes! Finally, it’s worth mentioning that the square eye of the adze is intentional. Since the head is held on only by the force of the swing, the handle can be removed for sharpening, a task that would be nearly impossible with the handle fixed in place.



ABOVE: *The depth lines for hewing were traditionally made using a string dipped in wood ash; consider using a chalk line or a straight board and a lumber crayon to connect the depth lines.*

ABOVE: *If you're hewing a long log, you'll have enough room to work safely with a partner, if you work at opposite ends. While one person cuts juggles on the top, the other person can hew the side.*

BUCKING LIKE A BEAVER

Begin by standing on the opposite side of the log from where you plan to chop. If the log is larger than 10 inches in diameter, it will be most efficient to chop halfway through, and then switch to the other side. If you are on a hill, start on the downhill side and finish on the uphill side in case the log rolls. Make sure your feet are firmly planted and well outside of the axe's path.

As in felling a tree, the most efficient chopping angle is 45 degrees, and the face of the scarf should be equal to the diameter of the tree, assuming you'll be chopping from both sides. On smaller logs you can buck from one side; simply make the notch wider so that it doesn't "vee out," or close, before cutting all the way through the log.

Bring the axe directly over your head, dominant hand on top. Do not drop the axe behind your head; this creates fatigue, not additional power. As you swing the axe, throw it out to create a larger arc.

As with felling, use a clockwise pattern to remove chips. If you find that you've veed out before cutting entirely through the log, simply move your kerf to one side, giving yourself a fresh chopping face.

As you near the bottom of the log, use shorter, less-powerful swings to avoid contacting the ground.

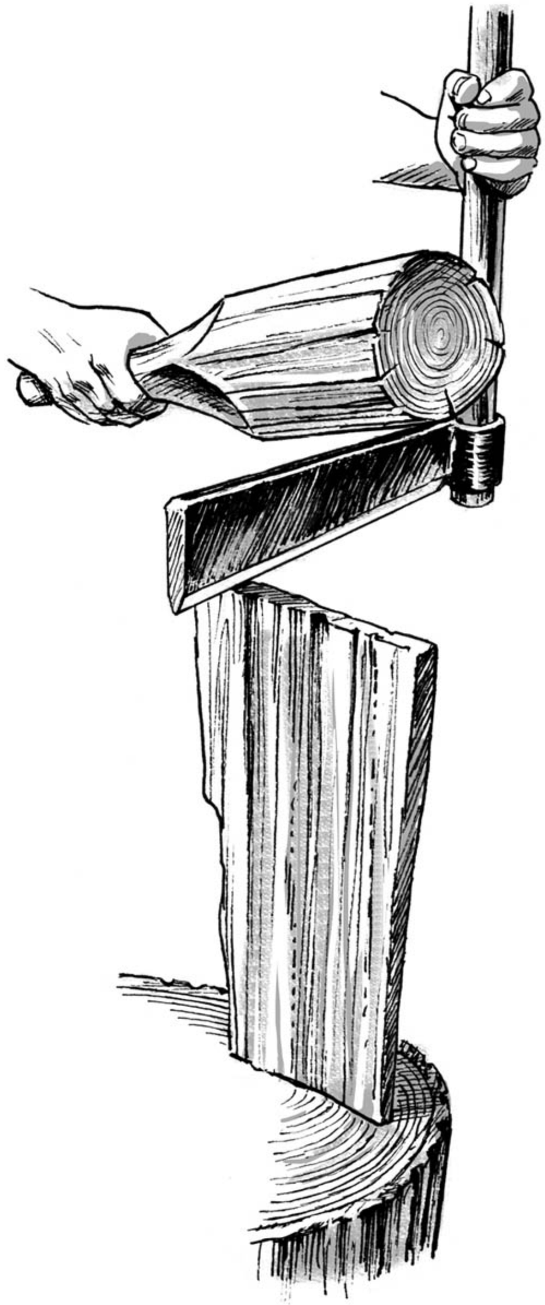
Making Shakes

While the early broadaxe was essential for forming square timbers used in post-and-beam construction, the froe played an equally important role, providing shakes for the roof and siding of early American homes. Froes can usually be found fairly inexpensively at barn sales, or you can fashion your own froe out of an old leaf spring or farrier's rasp. Froes are different lengths for different purposes. Those that are used for making shakes and small log cleaving (splitting) have a single-bevel blade that's 10 to 12 inches long. The eye of the handle is slightly tapered so that the froe's head doesn't fall off. Here's how to split your first shakes:

Instructions

1. Select a clear piece of wood at least 10 inches in diameter and 16 to 20 inches in length; cedar is best, but red pine, Scots pine, and jack pine are also commonly used, as well as Osage orange and black locust. Regardless of species, the wood needs to be straight grained and free of knots. Cleave the log in half, or into quarters if it's a larger log. Use a wooden mallet to drive the froe into the wood. Rock the blade back and forth to break off a 1/2-inch shake.

2. Rotate the shake 90 degrees and use the edge of the froe to even out the side of the shake.



THE PEAVEY

While the mighty axe rightly receives credit for felling most of the timber of the 18th and 19th centuries, it was the peavey that took the work out of moving these logs, on both land and water. This important tool, consisting of a long handle with a metal spike and levered hook on the end, was the creation of blacksmith and inventor Joseph Peavey. Peavey was an industrious Mainer with a penchant for problem solving. Among Peavey's inventions were the spill-proof inkwell, the wooden screw vise, the hay press, and the impressive Peavey hoist, which was known for yanking even the most stubborn oak stumps.

As the story goes, Joseph Peavey developed the namesake tool after watching several river drivers try to free a logjam on the Stillwater Branch of the Penobscot River in the spring of 1857. By modifying a cant hook so that it had a sharp point and a fixed-swing dog (hook), the peavey gave lumbermen a more efficient way to skid, deck, turn, and pry logs.

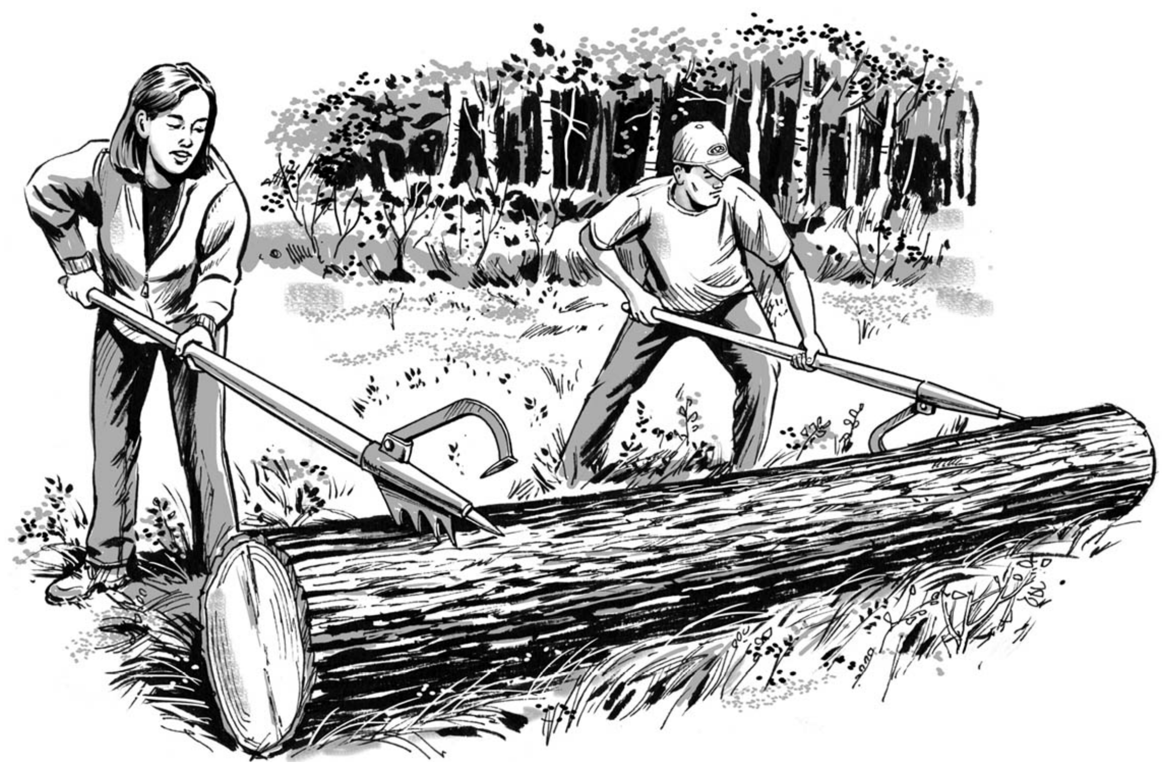
MODIFYING THE PEAVEY

As fine an example of practical engineering as the peavey is (virtually unchanged for nearly 160 years), there's still room for a couple of modifications that will yield greater efficiency on the landing and in the woodlot:

Add spikes. More spikes mean more contact with the log, ultimately making each stroke more efficient. By welding a second spike (often made out of an old railroad spike or a bolt) below the primary point, you're able to develop an efficient rhythm, yielding more push per stroke.

Bend the point. By bending the point, you'll create an angle that requires you to bend your body less and offers more contact with the log.

Make it a razorback. This modification, a series of points welded to the back of the peavey, has its roots in competitive lumberjack sports. The multiple points allow you to roll logs along the ground or up a log deck with ease.



ABOVE: *Peaveys take the work out of moving logs. Note the addition of the razorback spikes to the peavey on the left; these create multiple push points and increase efficiency.*

THE POOR MAN'S PEAVEY

At some point you'll find yourself in the woods with a hung tree (a felled tree that is suspended by one or more surrounding trees), but without a peavey to help lever the tree down. This method allows you to roll the hung tree using a homemade lever so that it falls to the ground. It goes without saying, but extreme caution is needed with this method.

Begin by sizing up the hung tree and determining which way it needs to roll.

Search out a strong 4-inch-diameter pole, 4 to 6 feet long. Make sure you cut this pole from a sturdy hardwood tree, because you'll be using it as a lever.

Use the attack corner of your chainsaw (see **Anatomy of a Chainsaw**) to bore into the log about 1 foot above the hinge.

Now bore in the opposite direction so that you have a square hole to insert your pole into.

If the hinge is still connected, release pressure by slowly cutting the hinge fiber on the side opposite the direction of roll.

Leave the hinge wood connected on the near side to reduce the chances of kickback.

Push the tree away using the pole. Let go of the pole and continue down your escape route as soon as the tree begins to move on its own.

THE BOW SAW

Bow saws can be used around the homestead in place of chainsaws for bucking firewood, cutting kindling, and clearing trails. Early bow saws were used by carpenters in post-and-beam construction. Later, the wooden bow saw was replaced by a metal bow saw that earned its spot in the woods cutting small-diameter pulpwood. These bow saws of the early and mid-20th century carried a 42-inch blade and measured 48 inches, including the handle. This meant that the bow saw was not only a handy felling and bucking tool but also the perfect measuring stick for cutting 4-foot pulpwood.

BUCKING FIREWOOD

If you'd like to buck firewood for your homestead using a bow saw, choose a longer saw, such as the 48-inch version used by early lumberjacks. While these large bow saws are no longer commercially manufactured, they are fairly common at flea markets and barn sales. However, to be serviceable, the saw should have been stored without blade tension. A worn-out bow saw won't have the proper tension and will likely result in a curved, dished cut.

When bucking with the bow saw, make sure you have a sturdy sawhorse or stanchion. The height of the wood you're sawing should be about 36 inches. To saw, place your dominant hand on the lower handle and your top hand approximately 4 inches in front of the curve at the rear of the bow saw frame. If you’re using a sharp blade, you won’t have to apply much pressure at all. Rather, your job as sawyer is to keep the saw frame over the blade, and make long, full strokes. A 20-degree angle is about right for most sawyers; this allows you to stand comfortably without being hunched over. You may also find that rolling the saw slightly forward on the push stroke yields more efficient cutting. On the pull stroke, make sure the teeth are fully engaged so that you’re cutting in both directions.

OTHER USES

Bow saws are also useful for maintaining trails and cutting coppice wood around the homestead. One advantage of using a bow saw instead of an axe when cutting saplings is that you’re left with clean, level stumps. With an axe, the remaining stumps are pointed, thereby posing a significant safety hazard. For basic trail maintenance and coppice harvest, opt for a smaller bow saw in the 16- to 18-inch range. These saws are inexpensive and endlessly useful.

ABOVE: *The weight of the log hanging off the end will open the kerf, making it easier to saw the farther you cut. Think of it as a reward for your labor.*

THE CHAINSAW

Perhaps no other tool is as valuable to the modern homesteader as the chainsaw. The chainsaw allows you to cut your own wood for building both human and animal shelter, efficiently harvest firewood, create pastures and silvopastures, cut fenceposts, build trails and woods roads, clean up after storms, and manage the ever-encroaching forest along pasture fencelines. The modern chainsaw represents a vastly improved product over earlier saws, which were dirty and extremely dangerous. Once you learn to safely operate a modern chainsaw, you'll have the confidence to tackle trees, both big and small.

SAFETY FEATURES

Developed in Germany by Andreas Stihl in 1926, the chainsaw has since evolved to be a safer, cleaner-burning, and more efficient tool. Among the safety features found on all quality modern chainsaws are an inertia chain brake, which stops the chain when it kicks back; a muffler with a spark arrestor; a rear hand guard; a chain catcher or catch pin; an antivibration handle system; and a throttle trigger interlock.

Collectively, these features reduce the risk of injury; however, understanding how a chainsaw works will help you avoid accidents. Essentially, you can think of the teeth of your chainsaw as consisting of alternate chisels that are able to efficiently cut wood when they're both sharp and at the proper depth. The depth of your cutter teeth is determined by the raker. To maintain the chain, you'll want to follow the manufacturer's instructions regarding tooth length and angle, as well as raker depth. Aggressively filing the rakers in an attempt to cut bigger chips (by allowing the teeth to cut deeper) also increases the chances of kickback, where the chainsaw bar is rapidly pushed back toward the operator. You can reduce the chances of kickback by understanding the reaction forces of your chainsaw: push, pull, attack, and kickback.

You'll note that the kickback position is the top corner of the bar. You should never attempt to saw directly with this corner of the bar. The lower corner, just below the kickback position, is the "attack corner," used for boring into the wood. Learning to safely bore with your saw is important because it will allow you to plunge-cut as part of the felling process.

PERSONAL PROTECTIVE EQUIPMENT

Before you ever think about firing up your chainsaw, you should invest in personal protective equipment (PPE). This includes head/face/ear protection, gloves, chainsaw chaps, and steel-toe boots.

An integrated forestry helmet combines an approved hard hat with face and ear protection, eliminating the need to buy and keep track of individual components. The cost of a hospital visit can be 100 times more than the cost of a pair of chaps. Without a doubt, this is a solid investment, since the most common chainsaw injury is a cut to the lower left leg and thigh. You'll also want to wear steel-toe boots, preferably boots that are impregnated with ballistic nylon, since foot and lower leg injuries are fairly common as well. Finally, invest in a pair of quality gloves that fit well, offer good grip, and allow you to operate the on/off/choke switches without needing to be removed.

ABOVE: *Personal protective equipment (PPE) goes from head to toe: note the helmet with face and ear protection, leather gloves, chainsaw chaps, and steel-toe boots.*

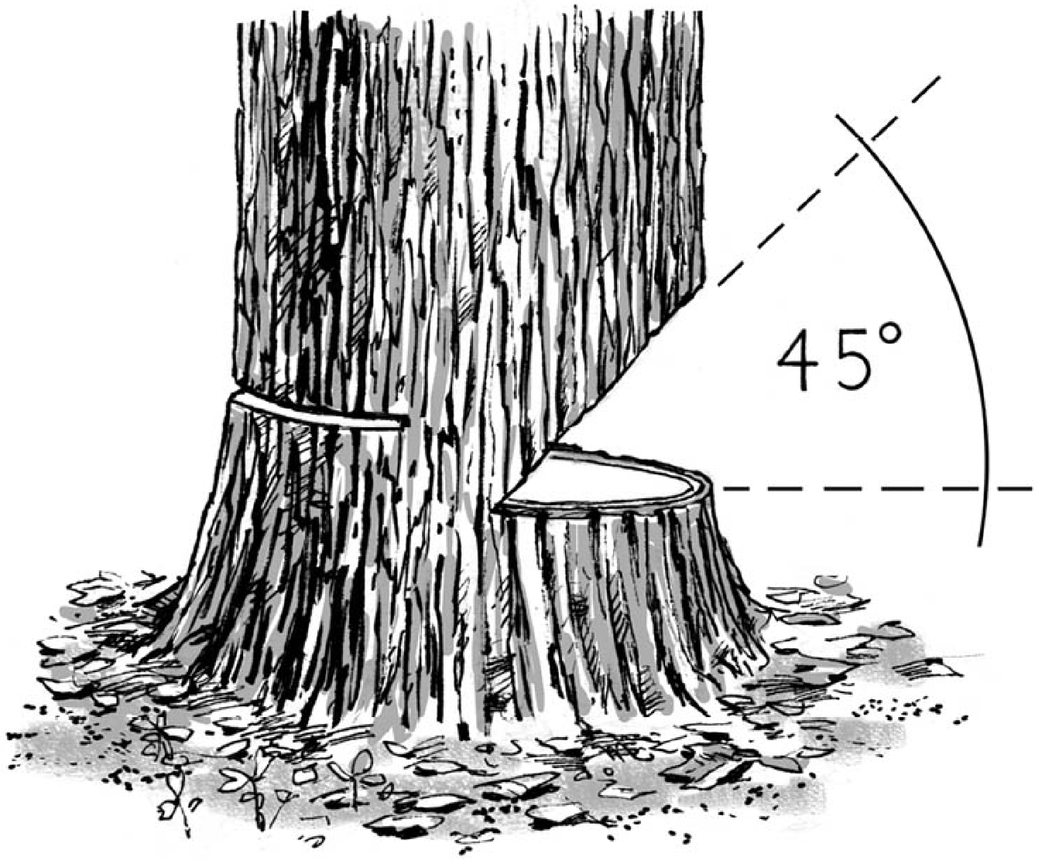
GETTING STARTED

Before you start your saw, you should conduct a preliminary check. Adhering to the following tips will reduce the chance of injury, increase your efficiency as a woodcutter, and make your time in the woodlot more enjoyable:

- Check for a properly sharpened chain. The edge should be burr-free and sharp to the touch.
- Check for proper chain tension. The chain should sit on the bar without drooping, but it should not be so tight that you can't slide a piece of paper between the bar and the chain when firmly pulling up on the chain.
- Inspect and tighten all bolts. Pay special attention to the bar stud nuts, which are notorious for vibrating loose.
- Make sure your catch pin is in good shape and that your chain brake is working.
- Fuel, oil, and start your saw at least 10 feet from ignition sources.
- Start your saw either on the ground, or with the rear handle firmly braced between your legs. Never "drop-start" a chainsaw.

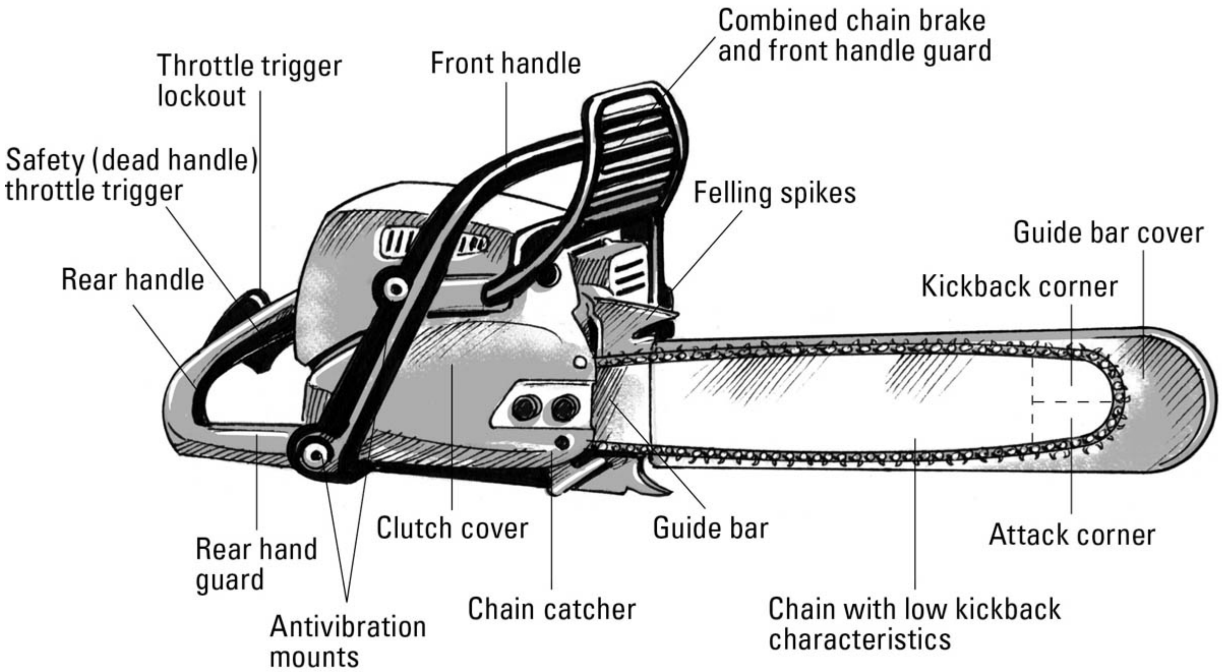
FELLING A TREE, OLD SCHOOL–STYLE

Ask any old-time woodsman how to fell a tree and you'll likely hear him describe some iteration of the conventional 45-degree notch. Without a doubt, variations of this notch have been successfully used — and *not* so successfully used. The persistence of the conventional notch can largely be attributed to the use of the crosscut saws in the 19th century, in which the flat undercut was bisected by a 45-degree scarf using an axe. When loggers migrated from crosscut saws to chainsaws in the first half of the 20th century, the conventional notch continued to be used. However, the conventional notch suffers from two flaws.



ABOVE: *The conventional chainsaw notch evolved from the days when trees were exclusively felled with axes and crosscut saws. Felling with a chainsaw allows us to improve upon the conventional method by employing a bore cut and a wider notch.*

ANATOMY OF A CHAINSAW



A narrow notch. The first problem is that its face, or notch width, is too narrow. As the tree falls, the direction of the fall is controlled only until the notch closes. Once the notch is closed, the hinge breaks off, leaving the tree to spin or split. For trees that are perfectly plumb, it isn't so much of a problem for the tree to fall the remaining 45 degrees without the hinge. However, for a tree that has even a small amount of side lean, the tree can spin off the stump, heading in an unintended and dangerous direction.

A dangerous back cut. The second danger with the conventional felling approach is that the back cut is typically a single cut starting at the back of the tree and sawing toward the hinge. In many cases, the sawyer continues sawing until the tree begins to fall. Being in proximity to a falling tree with a running chainsaw can be dangerous — especially if, during the excitement of felling the tree, the sawyer cuts too far on the hinge and has to scramble to escape an ever-accelerating and uncontrolled tree. If the tree doesn't fall under this scenario, there's a good chance the saw is pinched in the back cut. At this point, not only do you have to contend with freeing your saw, you also have a partially cut tree that poses a significant safety issue.

A SAFER ALTERNATIVE: THE OPEN-FACED NOTCH

Developed by Swedish foresters in the 1960s and brought to North America in the 1980s, a new notch, and an entirely new approach to timber harvesting, allowed the logger greater control and safety. The open-faced notch technique (cutting a notch with an angle of 70 to 90 degrees) offers greater control as the tree falls.

The following five-step felling plan offers a safe and systematic way to fell trees in your woodlot. While felling techniques could fill an entire book, this section is meant to serve as a primer on the topic.

Step One: Identify Hazards

While it is easy to assume your woodlot is a safe environment, a number of seemingly benign elements can pose a real risk to the sawyer.

Find the widowmakers. Do you see any dead or hanging limbs, either on the tree you're felling or in the crowns of adjacent trees? These hazards are appropriately named widowmakers. Think about how these branches and limbs are likely to fall, and make sure your felling plan keeps you a safe distance away.

Remove obstructions. After you've surveyed the overhead hazards, examine the forest floor. Are there saplings in the path of the tree? If so, it's easier and safer to remove them before you've felled your target tree. You'll also want to make sure that the area around the tree is clear of other obstructions, including vines, undergrowth, fallen logs, and roots or holes that could be trip points.

Look for cracks and decay. Now that you've examined the canopy and ground for hazards, take a look at the trunk (or bole) of the tree. Does it show signs of decay? How about a split? These are important clues that speak to the soundness of the tree. If you suspect decay, you can drill or bore into the wood to determine if the tree is sound enough to safely fell. If your boring experiment only yields punky sawdust, select another tree to fell. In the event of cracks or splits, it's important to note where they begin and end. If the crack extends into the base of the tree, it is best to leave it for wildlife and move on to a different tree.

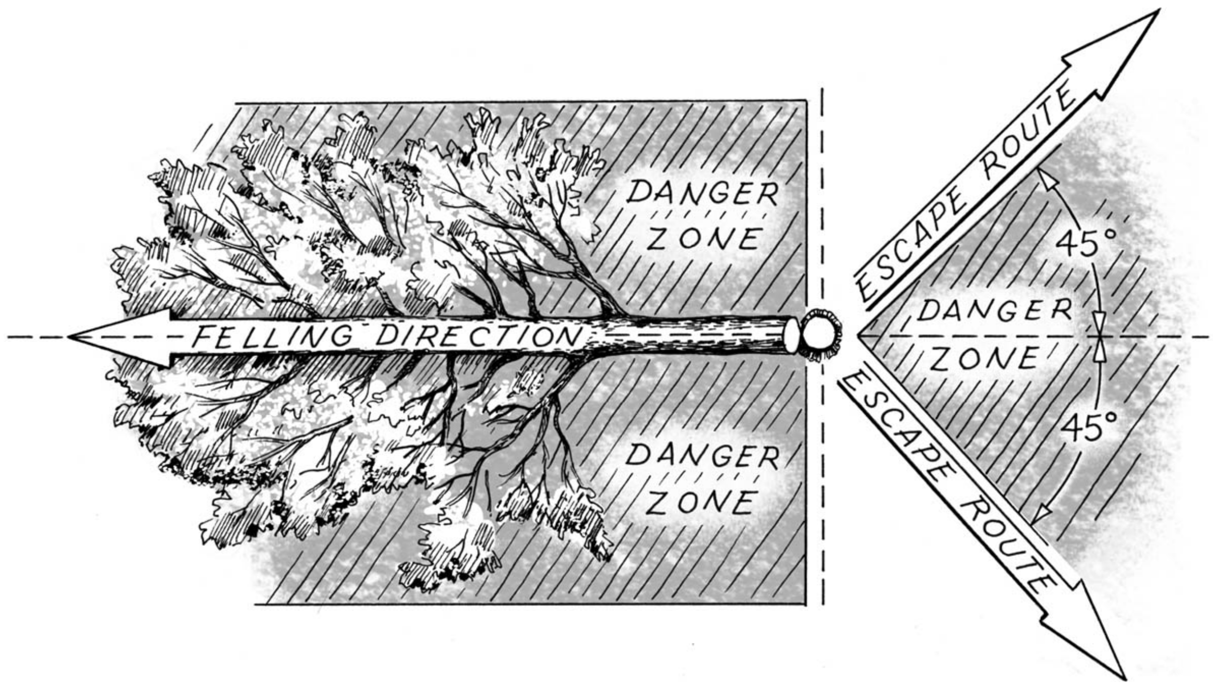
Finally, it's worth noting that the hazards don't end as soon as the tree hits the ground. It is fairly common for still-swaying branches and limbs from neighboring trees to fall after your targeted tree is on the ground. Take the time to look up, note hazards, and wait for the surrounding crowns to settle down.

Step Two: Identify the Lean of the Tree

Front, back, and side lean all influence the ease with which, and the direction in which, the tree will fall. To determine the lean, don't just look at the trunk of the tree. Stand far enough back that you can see the entire tree. In many cases, the trunk will sweep one direction, but the crown will go the other direction, which can either balance out the tree's lean or persuade it the other direction, based on the size of the crown. When sawyers talk about "side lean," they'll often reference the "good" or "bad" side of the tree. The good side leans away from the sawyer; the bad side leans toward the sawyer. Given a choice, you should always work from the good side of the tree when making the back cut. Front lean means that the tree wants to fall forward; in this case it's important to leave a strong hinge. For trees with back lean, it's important to set large enough wedges so that the tree can be tipped. If a single wedge doesn't offer enough height, stacking multiple wedges will often create the necessary mechanical advantage.

Step Three: Determine an Escape Route

Few considerations are as important as picking a good escape route for the sawyer. Studies have shown that nearly 90 percent of felling injuries occur within 5 feet of the stump. This alarming statistic highlights the importance of choosing and clearing the best route possible. Your escape route should be 45 degrees back and away from the felling direction. Never use an escape route that is directly opposite the direction of fall, since the tree may kick backward. Remember to work on the good side of the tree, and make sure that you take the time to clear brush and any potential tripping points in your way.



ABOVE: *While most trees offer two potential escape routes, you should always decide which route you're going to take, and stick to it so that you never have to enter the danger zone. As a general rule, you should use the escape route opposite the direction of side lean.*

Step Four: Make the Notch Cut

Your notch is important for determining the felling direction, as well as for controlling the descent of the tree. Remember that the back of your notch becomes the front of your hinge. The width of the hinge should be 80 percent of the tree's diameter. This means that if you're cutting a 15-inch tree, the width of the hinge would measure 12 inches, side to side. Knowing this allows you to cut your notch at the proper depth.

The open-face notch should be 70 to 90 degrees. This angle means that the tree will fall all the way to the ground with an intact hinge, eliminating the potential for the hinge breaking and the tree kicking back, as is common with the conventional 45-degree notch.

You'll begin the notch by sighting your felling direction. Most chainsaws have a built-in sighting line on the case that allows you to line up the saw with your intended target. With the saw pointing toward your target point on the ground, begin cutting at a downward angle of approximately 60 degrees. This cut should continue until you reach 80 percent of the tree's width. You can now make an upward 30-degree cut that bisects the 60-degree cut. This will result in a perfect 90-degree wedge. Either of these angles can be shortened, but the final notch should be 70 to 90 degrees. It is also important that the two cuts meet; a bypass of no more than 3⁄8 inch is acceptable. The risk of a bypass cut is that either the tree may split (called a "barber chair") or the hinge may break prematurely.

ABOVE: *The 70- to 90-degree open-faced notch offers greater control in felling than the conventional notch does, because the hinge is less likely to break prematurely.*

Protect Water Quality by Using Biolubricants

For your chainsaw to operate efficiently, the bar and chain must be continually lubricated. Until recently, virtually all bar and chain oil was petroleum based. Given that this oil is left behind on the stumps, limbs, and forest floor, it makes sense to consider using a plant-based, biodegradable bar and chain oil. In fact, many community watersheds *require* the use of plant-based oils to protect water quality. Most of these biolubricants use canola oil along with a tackifier that helps the oil stick to the bar, including additives that prevent the formation of sticky resins in your saw's clutch.

Step Five: Make the Back Cut

If a tree is small or has no lean, wedging is unnecessary; simply cut your open-faced notch on the front, and cut straight in from the back.

On larger trees or trees with lean, you should employ the bore cut and set wedges about an inch above the center of the notch. *It is extremely important that you use the "attack" corner (bottom corner) of the bar for the bore cut.* Begin your bore cut at the apex of the tree, leading with the attack corner and pushing into the tree, parallel with the hinge. If your bar is longer than the diameter of the tree, it will saw through the far side (which should be the "bad" side of the tree). Bring the saw forward to adjust the thickness of the hinge. The hinge thickness should be 10 percent of the tree's diameter.

Assuming the same 15-inch-diameter tree, your hinge should be 1 ½ inches. Maintain even hinge thickness across the width of the hinge. Once the hinge has been set, begin sawing away from the hinge. However, do not allow the saw to completely sever the back of the tree; leave a strap that is 5 to 10 percent of the tree's diameter. This strap is important, because it prevents your saw from getting pinched and also preserves an opening, or kerf, for inserting the all-important plastic felling wedge.

With the saw safely removed, and your escape route clear, insert a wedge (or multiple wedges on larger trees) and pound it with the poll of your axe until it's firmly set.

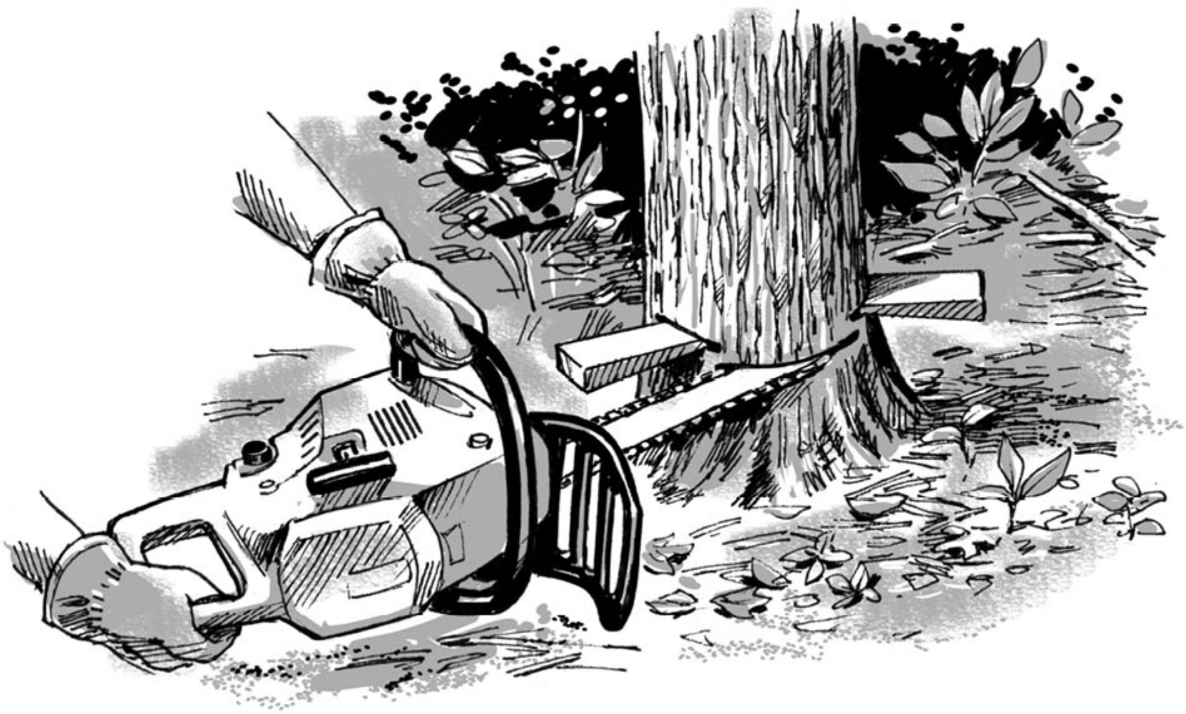
At this point, take the time to look down your felling lane to ensure it's clear of people, dogs, or other woodland creatures. Once clear, cut the remaining strap ½ inch below the back cut. At this point, the lift provided by the wedges should provide enough upward force that the tree falls; in that case you should set your chain brake and walk (don't run) 15 feet down your escape route. If the tree doesn't fall after you cut the strap, use the poll of your axe to pound the wedges until the tree begins to fall. If you pound your wedges all the way in but the tree still won't fall, stack multiple wedges (two, and then three if necessary) to create the needed lift.

For folks used to using the conventional "notch and drop" method, the reaction to the open-faced notch with the bore-cut hinge is always the same: "That felt so much more controlled." This control means that not only are you safer working in your woodlot but you'll also have a healthier woodlot. Hung trees and trees that break off the stump midfall often result in what foresters call "residual stand damage." This damage may be bark scraped from a neighboring tree or crushed saplings as a result of imprecise felling with a conventional notch.

Some of the most useful lessons of tree felling come after the tree has hit the ground. You should examine where the tree hit in relation to your intended target. Were you right on, or did you miss? Was your notch properly sighted? Was your hinge too thick or thin? Being aware of these details and learning to refine your technique will make your woodlot woodcutting more efficient and enjoyable.

ABOVE: *The bore cut is made by using the "attack corner" of the bar (see* **here***) to bore into the tree. Make sure your hinge thickness is even and approximately 10% of the diameter of the tree, and that the back strap is 5–10% of the tree's diameter. The more lean the tree has, the thicker the back strap should be.*

ABOVE: *On smaller trees, or those with little to no lean, one wedge is usually sufficient for felling. On larger trees you may need to use two or more wedges.*



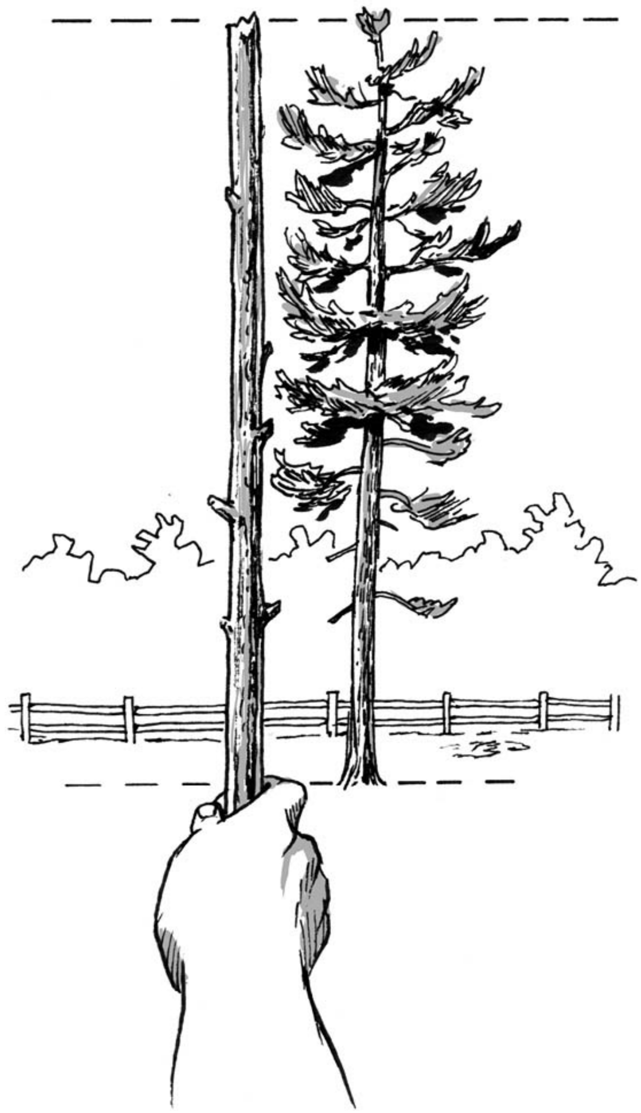
ABOVE: *Cut the back strap about 1 to 2 inches below the bore cut. This lower cut allows the wood fibers to tear vertically, contributing to a slower, more controlled descent.*

WOODLOT MATH,

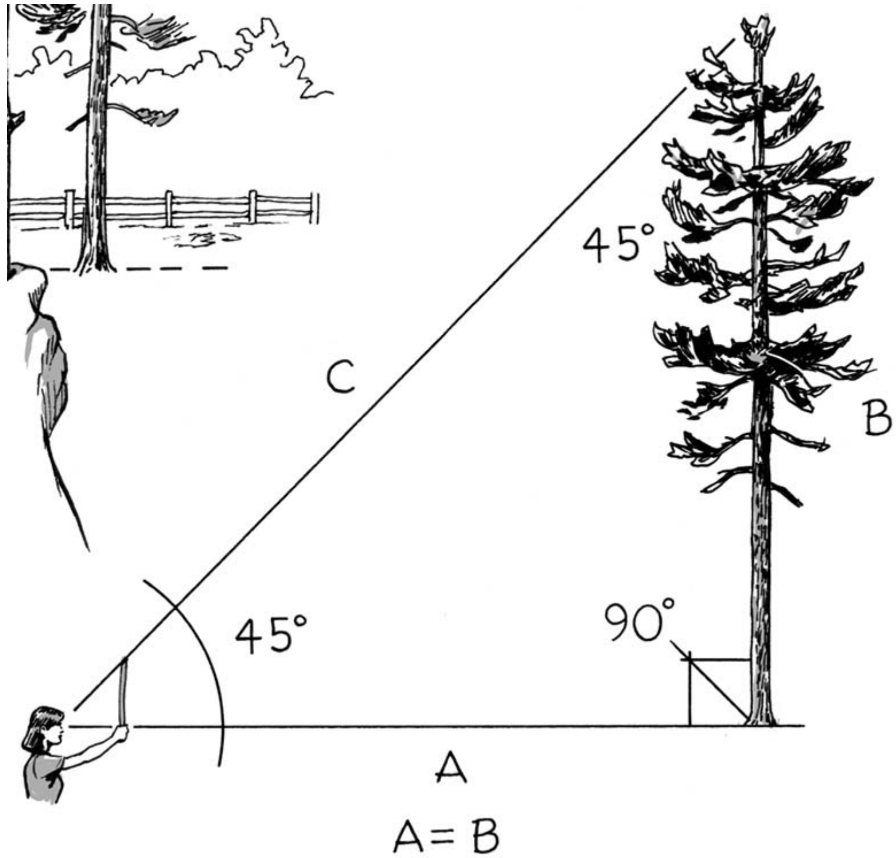
No Calculator Necessary

It's essential to determine the height of the tree before you fell it, so that you know exactly where the top will land. To do this, you could dig around in your geometry memory bank to find the Pythagorean theorem. Or, if the ground is reasonably level, you could use the following simple trick:

1. Find a stick that reaches from your cheekbone to your fingers when your arm is fully extended in front of your face. You may need to cut or break off a stick if you can't find one that's the exact length. Extend your arm, holding the stick up between your thumb and pointer finger, perpendicular to the ground.



2. Walk away from the tree until the top and the bottom of the stick are aligned with the top and bottom of the tree. Ideally, your sightline to the base of the tree should be as close as possible to horizontal.



Voilà! The distance from where you're standing to the base of the tree is equal to the height of the tree. If you've calibrated your pace as described in **chapter 1**, simply pace the distance back to the tree and convert to feet.

LIMBING WITH A CHAINSAW

Limbing, sometimes referred to as "chasing," requires just as much skill as felling and is just as potentially dangerous. Two errors stand out as being particularly common when limbing a tree. The first is an error in judgment that occurs when the sawyer lets down his or her guard after the tree is "safely" on the ground. The problem is that in most cases unsuspecting sawyers simply trade vertical uncertainty for horizontal uncertainty, whereby the enormous potential energy of bound limbs presents a dangerous surprise. The second error is the temptation to go "just a bit higher" with the chainsaw in order to reach limbs that may still be above shoulder height. The combination of the chainsaw being outside the control zone (above the shoulder) and the limbs being under pressure can have disastrous results. However, don't despair; by learning a few basic tricks of the trade, you'll be able to negotiate the trickiest of limbs.

Before you begin limbing, consider the following hazards:

- **What's overhead?** Remember that as your tree fell, it likely rubbed against the crown of surrounding trees and could have dislodged and/or created a widowmaker. Take the time to look up and evaluate overhead hazards.
- **Are there any pesky spring poles?** You'll recall that in the previous section we discussed how saplings and small pole-size trees should be removed prior to felling. However, doing so means cutting down younger, smaller saplings that represent future crop trees. Sooner or later, you'll hit a sapling that you hoped you could miss, thereby creating a spring pole (a limb or tree bent under pressure beneath a fallen tree). In that case, you'll want to slowly release the pressure from the spring pole using the method described below.
- **Does the tree want to twist or roll?** Especially large limbs can cause the tree to twist or roll. Removing large limbs in

sections using hinges is usually safer than trying to remove them whole.

- **What's the topography like?** Did the tree land on a hill or hummock, creating tension in each end of the stem? Is it on a hillside and likely to roll? Evaluating these landscape features will help you identify potential kickback and pinch points.

Limbing is the art of controlled pressure release. Understanding how pressure changes while you're sawing in the kerf of a limb is essential to safe removal. If a tree is leaning with side pressure, you can use a limb-lock method that slowly releases the pressure. You accomplish this slow release by cutting about halfway through the branch on the compression side and then cutting the second half on the tension side several inches down the branch.

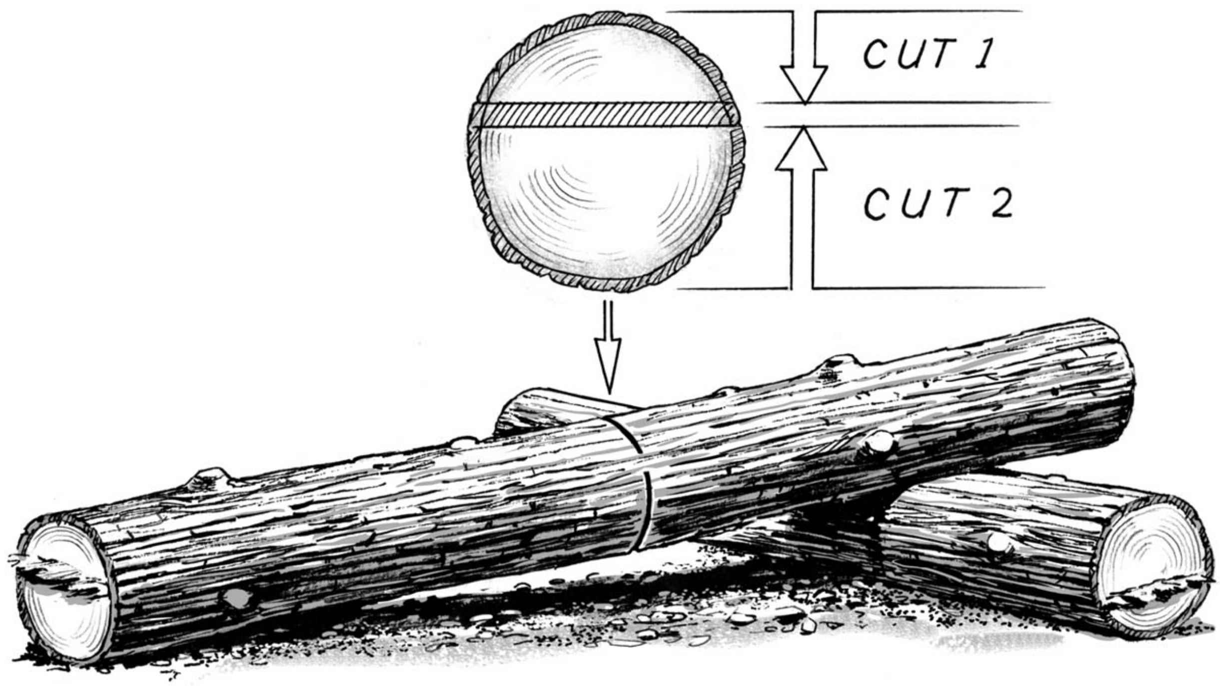
Spring poles can be particularly dangerous when the pressure is released too quickly and the branch flies into the face of the sawyer. The other danger is that the branch kicks the chainsaw back toward the sawyer's upper body. To avoid this, release the pressure slowly by making a series of shallow cuts at the apex of the spring pole.

> *"Chop your own wood, and it will warm you twice."*
>
> — HENRY FORD

BUCKING WITH A CHAINSAW

When bucking a tree with a chainsaw, as with limbing, compression and tension points will dictate how and where you buck the log. Complicating the bucking process is the likelihood that you're probably looking to cut logs or other products from the tree, thereby needing to incorporate additional factors in the bucking process. These factors include minimizing the amount of sweep or curvature in each log; bucking out defects, including wounds that may indicate decay; and working within log specification guidelines that dictate minimum and maximum diameters over a given length (e.g., selecting logs for a log cabin).

Bucking on hilly terrain poses the danger of rolling logs. Therefore, you should make sure to always buck the tree from the uphill side and have an escape route. As a general rule, you'll want to limb and then buck, starting at the butt of the tree and working toward the top. If the tree has compression on the top — meaning that your chainsaw would pinch if you cut directly down — use a notch-and-undercut method (see illustration below) to release the pressure. If, however, the compression point is on the bottom, as is often the case for suspended tops, use a bypass cut, where you begin on the bottom by cutting one-third to one-half of the diameter, and then cut the top with a 2- to 3-inch offset. This offset gives the energy a place to go, while safely allowing the log to sever.



ABOVE: *To avoid pinching your saw while bucking, use a bypass cut: saw partially through the top, and then finish on the bottom. If you feel your saw beginning to pinch, stop and cut from the other direction.*

BUILDING THE PERFECT SPLITTING BLOCK

Splitting blocks serve several important purposes. First, by splitting on a wooden block, you're preserving your axe by avoiding rocks. Second, splitting on a block is safer since it gives the axe a known landing spot well away from your feet. Third, a splitting block can save you from having to bend over as far. Your back will thank you!

Begin by selecting a block that is a minimum of 15 inches in diameter and 12 to 16 inches high. The knottier, the better; the knots will prevent it from splitting prematurely. Any species will work, but I prefer elm or sugar maple.

Find an old tire that's just slightly larger than the diameter of your block. Drill four 1-inch holes in one sidewall, evenly spaced (this will allow water to drain). Use four 3-inch lag bolts with fender washers to screw the sidewall of the tire to the top of the block.

You now have the perfect splitting block that will hold your wood securely as you split it. No more standing up fallen pieces or chasing runaway firewood!

If you're splitting small-diameter wood, you can pack the pieces inside the tire; they will support one another while you are splitting.

Beside your tire-topped splitting block, you may want to have a second block without a tire for large or odd-shaped pieces. I also recommend putting a slight angle (about 10 degrees) on this second block so that you're able to match an uneven piece of firewood with the angle of the block.

SPLITTING FIREWOOD

Because processing your own firewood is such a labor-intensive activity, it makes sense to plan out all the steps in advance to minimize the number of times you have to handle the wood. In constructing your plan, think about where the wood is harvested, what tools you have at your disposal, and options for getting the wood to the woodshed. (The instructions in this section refer to splitting wood by hand; don't disgrace the wood by using a power splitter.) No doubt, the victorious feeling of splitting a stubborn log with only an axe makes it a fair fight and will always trump the monotony of pulling the hydraulic lever of a power splitter.

In some cases, it may make more sense to split near the felling site, since pieces of firewood are easier to load and move than large rounds are. Processing wood at the felling site reduces the damage to residual trees that often results from skidding tree-length logs. Finally, the detritus from the process (nutrient-rich sawdust, bark, and branches) is left in the woods and returns to the soil.

CHOOSING AN AXE FOR SPLITTING

Splitting is different from chopping: with splitting, you're bisecting the wood along the grain, instead of diagonally cutting it. Therefore, to effectively split wood, you'll need an axe that works less like a knife and more like a wedge. Your first option is to convert an old felling axe into a splitting axe. Since you're looking for a fat wedge to pop the wood apart, seek out a well-worn felling axe with a short face from being ground and abused. Use a flat file at a 40-degree angle on each side to create a blunt wedge. If the axe has been out of service for a while, make sure the handle isn't cracked or loose.

SPLITTING WITH A MAUL

Another option for wood splitting is a maul. The advantage of the maul is its mass, which allows you to power through the log with each blow. Mauls can range in weight from 6 to 16 pounds. But remember: what you gain in mass isn't free. You'll still need to lift the maul, which can be tiring. I prefer lighter mauls that allow me to work longer without getting tired. There are also several new hybrid mauls that incorporate the thin cheek of an axe with the thick poll of a traditional maul.

HOW TO SPLIT WOOD

You're not working on the railroad, so don't roundhouse over your shoulder. Instead, raise the axe directly over your head. By keeping the axe in a perfect line with the center of your body, you'll develop greater accuracy and precision.

Space your legs wide enough so that they're free and clear of the axe should you miss. Also make sure you're wearing steel-toe boots.

As you line up with the log, make sure you're far enough away that you don't "wood," or strike the handle of the axe on the log. This happens when your arms and body are outstretched more during the actual swing than during the swing lineup.

Although standing farther back from the log can help avoid this, consider adding a handle saver — a rubber ring placed on the shoulder of the handle. The ring works as a shock absorber in the event of a missed hit. You can purchase a commercially made handle saver, or you can make your own out of a 3-inch section of rubber radiator hose.

As you bring the axe down, aim for the near edge of the log. It's always easier to start a split at the edge than in the center.

If the log shows no sign of splitting after a couple of blows, rotate it 90 degrees and try from that side. If you still can't manage to pop open the log, consider "slabbing" the log by removing inch-thick slabs. Once the slabs are removed, you can resume your regular splitting pattern.

The final option for splitting wood by hand is to use a sledgehammer and metal wedges. This method is particularly useful for splitting knotty logs with uneven grain. If you opt for this method, make sure your wedge is placed beside the knot, not directly in it. If the knot is at one end of the log, split it from the opposite end. Also, it's best to start at the edge of the log and set additional wedges (if necessary) as you work toward the center. You may choose to use your axe or maul since much of the tension in the wood is released once the initial split is made. Some folks argue that splitting gnarly logs is too time consuming; however, remember that the reason the log is so tough is that the wood had dense, uneven grain. It is this dense grain that is richest in energy. In my own cabin, these pieces are coveted as "all-nighters" capable of pumping out consistent heat well into the morning.

ABOVE: *When splitting wood, bring the axe directly overhead (instead of over your shoulder) to increase your precision.*

ABOVE: *Aim for the near edge of the block (not the center) to make splitting easier. Note the wide foot stance that allows the axe to travel between the legs in the event of a glancing blow.*

BUILDING WITH CORDWOOD

While it's hard to deny the value of a cord of wood for keeping you warm, cordwood can also be used as a simple and efficient alternative building material. Cordwood building is simple; debarked firewood-length logs (8 to 24 inches long) are stacked with an insulated mortar to create a wind- and watertight wall.

Source and Cut Your Logs

It's imperative that the wood be completely dry before you begin, so start this process at least one year in advance of construction. Softwoods are generally preferred over hardwoods (which are prone to greater expansion/contraction); cedar is among the most desirable woods since it's rot resistant. You can use either rounds or split wood; just make sure all pieces are cut to the same length.

Mixing Mortar

Once your wood is dry and you've built a solid foundation above grade, you're ready to mix your mortar. Like cooks, most cordwood builders have their own recipe, but this one is the most common: 9 parts sand to 3 parts sawdust to 3 parts builder's lime (not agricultural) to 2 parts Portland cement by volume.

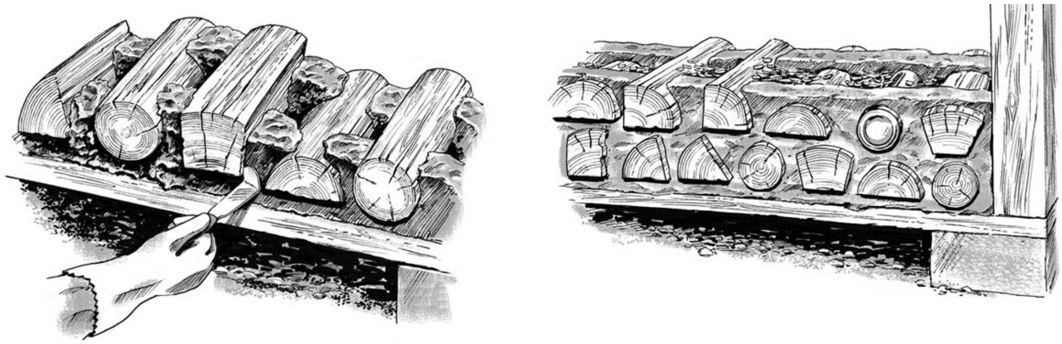
Laying Up the Wall

With the mortar mixed to the consistency of thick mud, you're ready to begin building, or "laying up" the wall. Start with a layer of mortar at the base (about 2 inches thick), and press the cordwood until firmly bedded. The logs shouldn't touch one another, and mortar should fill all the air gaps.

With your first course in place, you can begin continue building the wall layer by layer. Make sure the wall doesn't bow in or out, and that the areas around door and window frames are completely chinked with mortar. Before the mortar dries you'll want to smooth, or "point," both the inside and outside of the wall using a butter knife with a slightly upturned blade. Use the knife to both smooth and compress the mortar, adding to both the strength and appearance.

Let It Dry Slowly

It can take up to three weeks for the mortar to completely dry. It's best if it dries slowly, and you can control the rate by misting the wall daily with water. (For more information on cordwood construction, see **Resources**.) See **here** for completed cordwood house.



ABOVE: *Point the mortar between logs with a small trowel or a butter knife that has an upturned blade. Individual logs should not touch; they should be separated by a thick layer of mortar.*

SKIDDING LOGS

Sooner or later, you'll find that you have a log you need to bring out of the woods to process, whether it's a maple log that will be milled into a new kitchen counter or log-length firewood that you'd like to process closer to the woodshed. Skidding, or "twitching," is the process of dragging logs. This section outlines the advantages and limits of four distinct skidding methods, starting with people power and ending with tractor skidding.

PEOPLE-POWERED SKIDDERS

If your homestead woodlot is small, consider skipping the gym membership and skidding logs by hand. If you’re mostly cutting coppice wood or other small-diameter material, this is likely the best approach. The people-powered log-moving and skidding tools include pickaroons, timber carriers, chainsaw winches, and the hand-pulled skidding arch.

Pickaroon

Also known as the hookaroon, the pickaroon consists of a 3- to 5-inch tapered hook mounted perpendicularly on an axe handle. You can stick the pickaroon in the top of a small log and drag it, or drive it into the end of a log to lift and drag at the same time. This is a handy tool for firewood operations, but it is largely ineffective for logs over 6 inches in diameter.

ABOVE: *A pickaroon is ideal for dragging firewood. To release the log, lower it to the ground and push back on the handle.*

Timber Carrier

A timber carrier is a two-person skidding device consisting of a 4-foot handle with a pair of swing dogs (hooks) in the center. The swing dogs work like a grapple, diving deeper into the log as more pressure is applied.

ABOVE: *Using a timber carrier requires not only a strong partner but also good communication; make sure your partner knows when you're getting ready to lift, drag, and stop.*

Chainsaw Winch

When working in tight areas, the chainsaw winch can be a great way to skid trees short distances or to free a stuck tree from the surrounding crowns. The winch mounts on the bar studs of the chainsaw and is generally better suited to large, commercial-grade saws. To double the pulling capacity of the winch, consider using a snatch block (a pulley block with a side plate that opens to allow a cable to be inserted).

ABOVE: *A chainsaw winch is ideal for moving logs in remote locations and tight operating spaces. It can also be used for other applications such as freeing stuck vehicles and hoisting logs in cabin building.*

Hand-Pulled Skidding Arch

The hand-pulled skidding arch lifts one end (or in some cases both ends) of the log, making it possible for one person to move a log that weighs as much as 1,500 pounds. Pneumatic all-terrain vehicle (ATV) tires allow the arch to easily roll over the roughest of ground. If you opt for a hand-pulled skidding arch, make sure you have friends to help take turns with it; the work is rewarding but extremely tiring.

SKIDDING WITH AN ALL-TERRAIN VEHICLE

Given their popularity, all-terrain vehicles (ATVs) often offer a practical solution for removing logs from the woodlot. If you don't already own an ATV and are considering purchasing one for logging, you're better off selecting a large 4×4 model (500+ cc) since hauling and skidding logs requires a substantial amount of power. Also, because of the heavy hitch load, it may be necessary to add additional weight to the front of the ATV. Finally, make sure you use extreme caution when skidding with an ATV, particularly on uneven or hilly terrain. If you're unsure about whether a load is too heavy, err on the side of caution and make an extra trip.

The three most common ways of skidding or hauling wood with an ATV are skidding pans or skidding cones, skidding arches, and forwarding or utility trailers.

Skidding Pan/Skidding Cone

Skidding pans are easy to make at home using an inverted car hood or a scrap piece of sheet metal. They offer an effective way to reduce drag on the front of the log; the curved front also allows the pan to glide over roots and rocks. The log is generally fastened to the pan by a chain and binder, and then chained to the hitch plate on the rear of the ATV.

Similar to the skidding pan is the skidding cone, which goes over the nose of the log, with a choker chain passing around the log and through the point of the cone, then to the ATV hitch.

ABOVE: *Skidding cones prevent the end of the log from digging in, therby reducing soil disturbance and allowing for larger logs to moved with less horsepower.*

Skidding Arch

Your next option to use with an ATV is a skidding arch. Currently, there are over two dozen commercially produced ATV arches. They vary greatly in terms of capacity, maneuverability, and choking/hitching setup. Some of the major considerations are described in the following paragraphs.

ABOVE: *When pulling smaller logs with a skidding arch, you may be able to balance the load by hooking in the middle of the log. For larger logs, it's a good idea to let the butt end drag; it will serve as a friction brake on hilly terrain.*

Self-loading versus manual. Self-loading arches are designed to lift the load as the ATV operator drives forward. This works well either with smaller logs or larger ATVs. The primary benefit of self-loading systems is speed. Manual arches use a hand-crank winch to lift the log off the ground. This reduces the initial drag but takes more time to hitch up.

Choker chain versus log tongs. A choker chain is usually about 5 feet long with a slip, or choker hook, at one end and a needling pin at the other end to help feed the chain under the log. The advantage of the choker chain is that it allows you to bundle small logs in a single hitch. Log tongs offer the advantage of being able to grab and go. However, log tongs sometimes have difficulty holding hard or frozen wood.

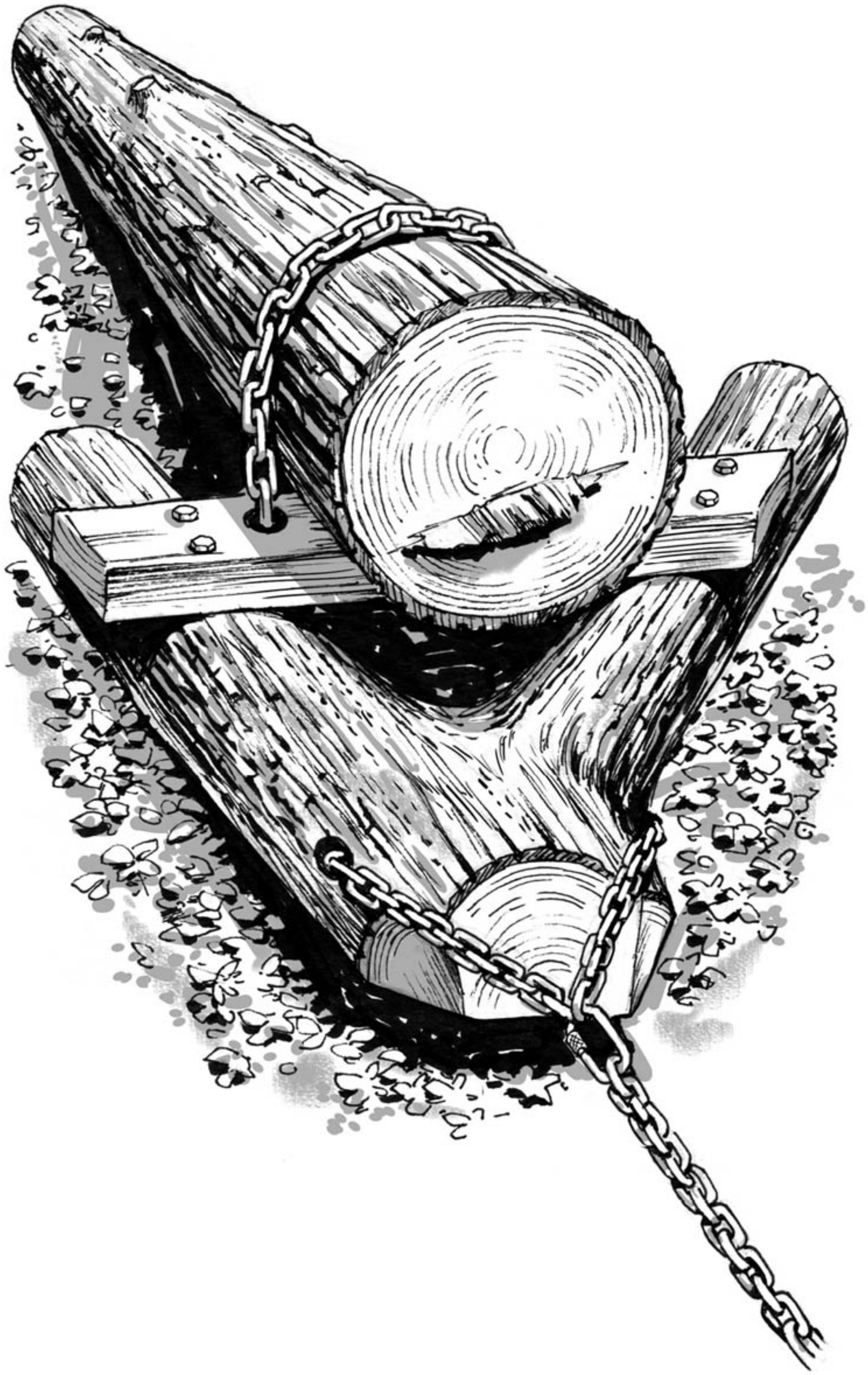
Two- versus four-wheeled arch. Most arches are two-wheeled, meaning that unless a log is short and perfectly balanced in the center, the rear of the log will still drag on the ground. There are several four-wheeled carts on the market that allow for both ends of the log to be lifted, thereby reducing ground disturbance. The disadvantage of the four-wheeled cart is limited maneuverability, particularly when backing up to the log.

Utility Trailer

If the logs you’re hauling with your ATV are small, or if it makes more sense to process the firewood while in your woodlot, consider making or purchasing a durable utility trailer. In addition to hauling wood, a multipurpose utility trailer will find unlimited employment around the homestead.

BUILDING YOUR OWN GO-DEVIL LOGGING SLED

The go-devil was likely developed by early homesteaders in Appalachia, though various iterations of this simple design can be found worldwide. The go-devil works much like **skidding pan** and **skidding cone** discussed previously. Lifting the nose of the log off the ground and onto a set of skids helps reduce friction and keep the log clean. A go-devil is suitable for either a single horse or single ox. Because it uses a chain instead of fixed shafts, the go-devil can be maneuvered in tighter spaces. Here's how to make your own go-devil:



ABOVE: *The nose of the go-devil is trimmed to act as a skidding cone that rides over obstacles and keeps the log clean.*

1. **Trim the tree.** Begin by finding a forked tree with equal-size leaders on each side. You'll want to select a branch fork that is between 5 and 8 inches in diameter. Cut the fork so that you have 8 to 12 inches of solid wood extending in front of the intersecting leaders. Trim the forks so that the overall length is approximately 4 feet.
2. **Attach the hitch plate and drag chain.** Use four 4-inch lag bolts to mount a 2" × 8" hitching plate across the middle of the go-devil. Drill a 1 1⁄2-inch hole on each side of the hitching plate to allow a chain to pass through the plate. Drill a third hole of the same size horizontally through the front of the sled for your drag chain.
3. **Load the log.** To load your new go-devil, simply roll your log up the side leg of the sled. If the height is too much to negotiate, use a small pole as a ramp and roll the log onto the hitching plate using a peavey. Once the log is in place, cinch the hold-down chain using a chain binder. Hook the front chain of the go-devil to a singletree behind the horse or ox. Smaller logs can be bundled to make for more efficient hitches.

SKIDDING WITH DRAFT ANIMALS

For many people, animal power represents an attractive addition to the homestead, and with good reason. The thought of trading noisy machines for the jingle of trace chains, or dirty exhaust for nutrient-rich manure, seems almost too good to be true.

However, before you buy a team of Belgians or a yoke of Devons on a whim, you should evaluate both your time and your resources. Unlike tractors and ATVs, draft animals involve daily commitment with regard to their care and weekly, if not daily, commitment with regard to their training. The bond that develops out of close interaction pays dividends in the field and woodlot. A properly trained draft animal will respond equally well to verbal commands and driveline or goad (prod) commands. In the woodlot, where your hands are likely to be occupied with choker chains and other logging tools, being able to communicate verbally is essential. It makes working in the woods both more efficient and safer, as you need to be aware of hazards to both you and your draft animal.

Choosing Draft Animals

If you're serious about integrating draft animals into your woodland homestead, start by spending some time around folks who use draft animals. Horses are the most popular draft animals, followed by oxen. Other draft animals suited to small-scale woodlot tasks include miniature mules and goats.

Horses and oxen are generally run as teams; however, both can be run singly. Most of the work on my woodland homestead is done is with a 14.2-hand Haflinger horse who’s able to skid a 12' × 14" log with ease. I move smaller coppice firewood by bundling multiple stems, making the operation more efficient. Using a single horse means not only a lower feed bill but also access to tight locations. It isn’t uncommon for us to skid logs between trees that are less than 3 feet apart without causing damage to the trees on either side. Ground skidding is done with a singletree in winter and a “ **go-devil**” when the ground is soft or muddy.

Working Safely with Draft Animals

Logging with draft animals is the ultimate challenge in multitasking. You must be aware not only of the regular hazards associated with logging but also of a host of other potential hazards related to your animal. Here are some basic tips to help keep you and your animal safe while working in the woods:

- Condition your draft animal to the sounds of woods work. This may mean running a chainsaw near the barn or tossing logging chains around when they’re in the paddock. Being used to the sights and sounds of woods work reduces the chances of your animal being spooked.
- Always be on the uphill side of your log. Unlike being on a tractor or an ATV, you’re often working from the ground, alongside the log. This can be particularly dangerous, especially on hilly terrain. Maintaining an uphill position will help reduce the chances of the log taking out your feet.

- Never put yourself between the log and a pinch point such as another log, tree, rock, or stump. Be particularly aware of this when taking sharp corners with a load.
- Work fast enough to be productive, but slow enough to be safe. Take pleasure in the pace that's comfortable for you and your animal.
- Know when to stop. Unlike mechanized equipment, your teammate is prone to fatigue in the same way you are. Missteps and slips are always more common with tired teamsters and tired animals than with fresh ones.

While the decision to incorporate draft animals into your woodland homestead should not be made lightly, the rewards come in the form of personal enjoyment and a healthier woodlot. The hooves of draft animals cause much less soil compaction than the tires of tractors or ATVs. And whereas engine-powered machines may leak fuel or hydraulic fluid, animals leave behind only organic fertilizer, free of charge!

If the thought of using draft-animal power is appealing but you're not ready for the commitment of adopting a set of hooves, consider hiring a horse logger to work your property. Depending on your skills, the logger may be willing to take you on as an assistant, bucking or decking logs, and just maybe you'll get to try your hand at driving. Being around draft animals on your property will give you a good idea if draft animals are right for you and your homestead.

TRACTOR SKIDDING

If you already own a compact tractor, you're well on your way to skidding wood. Your options vary from inexpensive and low-tech to spendy and high-tech.

The most basic way to skid wood with a tractor is to simply bundle, or "choke," it with a chain that's connected to the drawbar of the tractor. As with other skidding methods, this basic approach can be improved by using a skidding pan, skidding cone, or go-devil. Not only will this keep your logs cleaner but it will reduce drag and soil disturbance along your skid trail.

Using the Three-Point Hitch

If your tractor is outfitted with a three-point hitch, you have several options that will make skidding easier and more efficient. The most basic approach is to attach a grab hook to your drawbar, hitch the skid chain to the drawbar, and raise the drawbar. Depending on your tractor, you may find that your drawbar doesn't provide enough lift. A second option is to either purchase or fabricate a three-point-hitch skidding plate. This serves two purposes: first, by using the top link of the hitch, you're able to pull logs higher off the ground, and second, the lower portion of the plate prevents the log from riding under the tractor.

Using a Winch

The tractor skidding methods described so far work well on level ground. If your woodlot is hilly, you'll want to be extremely careful and consider using a logging winch, which will allow you to pull the log to you (up to 200 feet) instead of driving over hilly or uneven ground to get to the log. While logging winches are expensive, they're worth their weight in gold. Because they are so powerful, one danger is that as you go to winch the log in, the front of the tractor could raise off the ground or even flip. Always err on the side of smaller loads. As one experienced old-timer told me, "I always chain the front of my tractor to a nearby tree when winching. . . . It's cheap insurance."

The three-point-hitch tractor winch is also useful for winching hung trees or freeing yourself from a mud hole. The blade on tractor winches can also be used to push logs into a pile (decking) or to smooth out ruts in a trail. Winches are available for tractors from 17 horsepower up; just make sure your tractor and winch are appropriately sized for the wood you want to skid.

THE PORTABLE SAWMILL

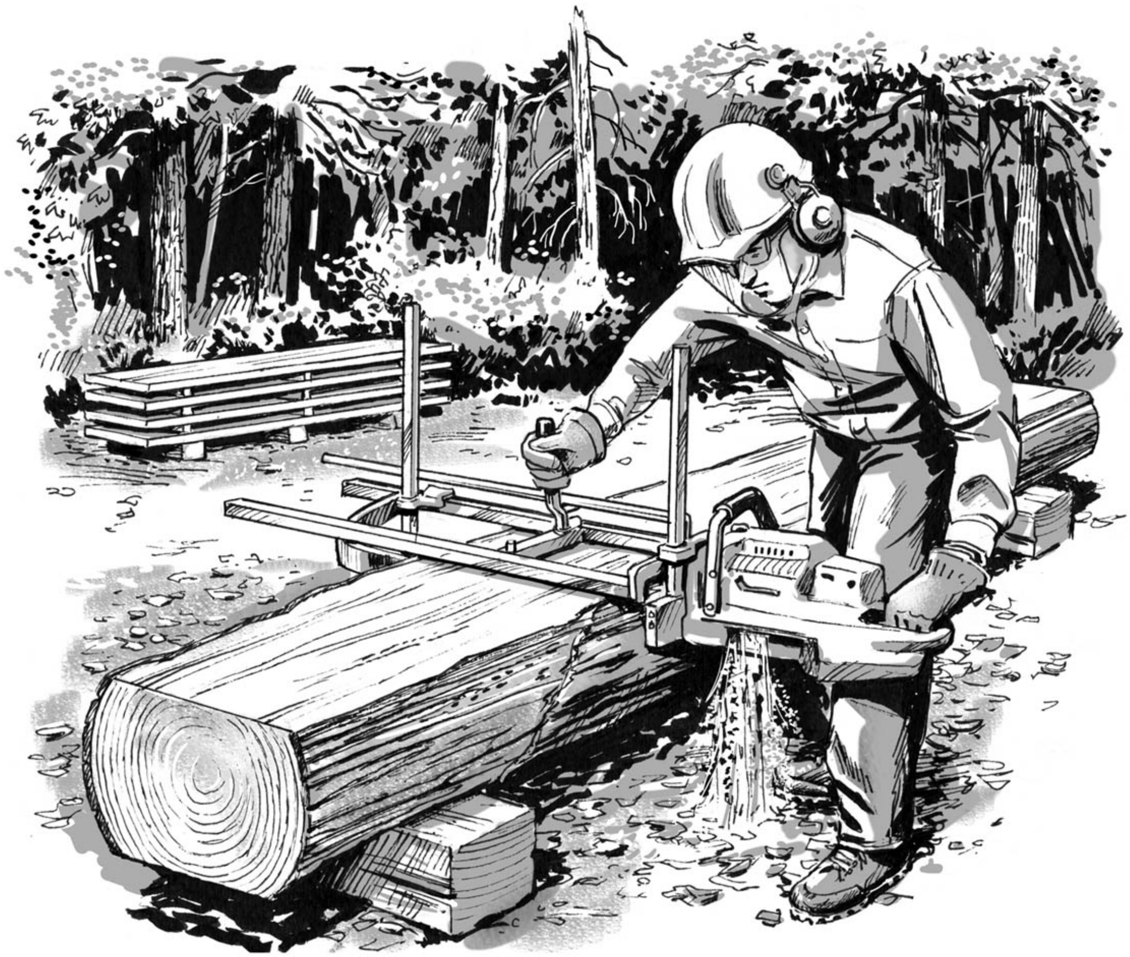
For many woodland homesteaders, the entry point to milling their own wood begins with a trip to the lumberyard, followed by sticker shock that's akin to being hit over the head with a two-by-four. However, the decision to begin milling your own wood can represent a significant investment of both time and money, despite the potential savings. To help guide you through this process, consider the following points.

HOW MUCH WOOD DO YOU WANT TO MILL?

The scale of your homestead woodlot and the length of your building project list will help you decide if purchasing a mill is in your long-term interest. If the scope and scale of your home-grown lumber ambitions is limited to, say, a chicken coop and a new woodshed, you may want to consider hiring a portable sawmill operator to mill your wood on-site. While you'll still have the satisfaction of harvesting your own wood, you'll avoid the overhead, maintenance, and depreciation associated with sawmill ownership. Portable sawmill operators generally work on either a per-hour rate or a board-foot rate. These rates will vary greatly based on local competition, distance traveled, wood species, site access, and volume of wood to be sawn. Other operators work on what's known as halves, meaning that they'll mill your wood in exchange for half of the milled lumber. If you have a surplus of logs, this barter system may just be the ticket to getting your wood milled on the cheap.

WILL A CHAINSAW MILL FIT THE BILL?

If your lumber needs are modest and you're interested in doing the work yourself, you may want to consider a portable chainsaw mill. These mills are a small fraction of the cost of a portable band saw mill and can be used with your existing saw, assuming it's at least 60 cc. Smaller saws don't have the power to run a ripping chain, which is necessary for sawing in line with the grain. Also be aware that the kerf, or width of the saw blade, is significantly thicker on a chainsaw, meaning that you'll end up with more sawdust and fewer boards. It's worth mentioning, though, that the chainsaw mill is the most portable of all sawmills. I once helped build a remote cabin in southeastern Alaska where all of the wood was milled using the appropriately named Alaskan chainsaw mill. Given that the building site was a 10-mile hike from the nearest road, trailering a portable band saw mill was out of the question. The chainsaw mill, which we strapped to our backpack in two pieces, was just the ticket.



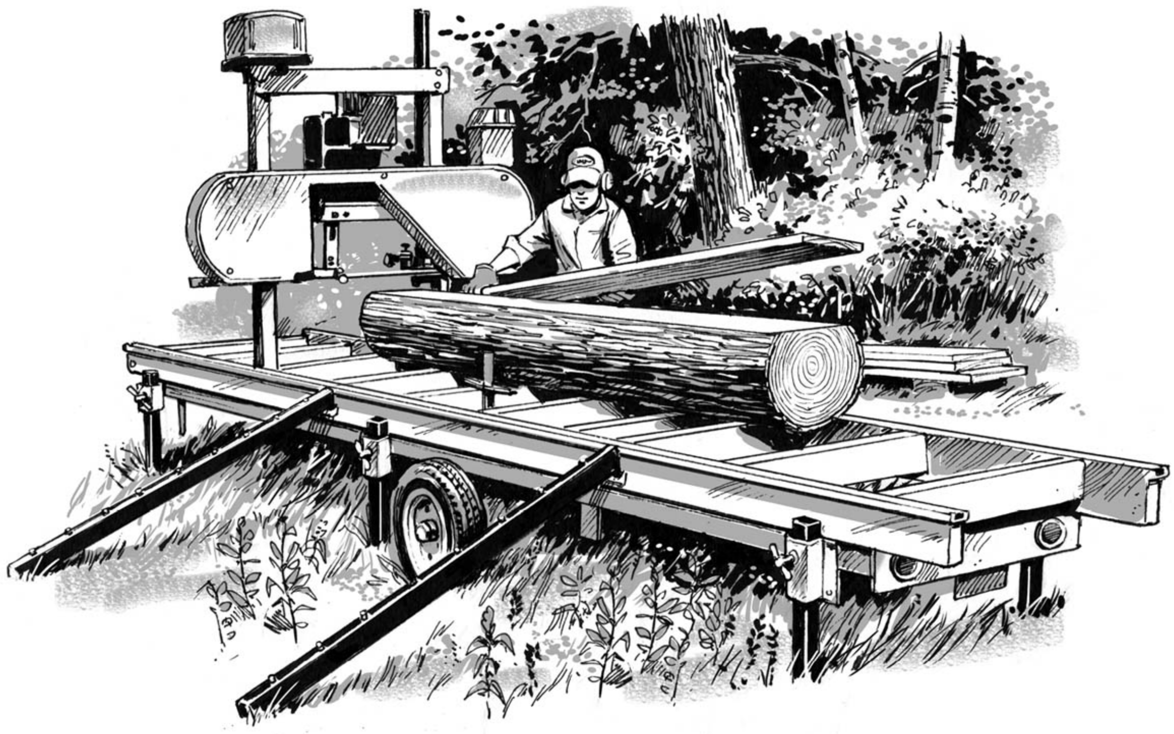
ABOVE: *Consider a portable chainsaw mill if your project is particularly small, or if it's located in a remote area where the logs can't be extracted for milling.*

SELECTING A PORTABLE SAWMILL

If you've decided that your woodlot ambitions are best met by purchasing a portable band saw mill or circular mill, you'll be met with a wide range of options and price points. There are several portable circular sawmills on the market; however, most are band saws that use inexpensive, narrow-kerf band blades. The power plants for band saw mills range from 6 to more than 70 horsepower and vary in terms of their production potential from 200 to 1,500 board feet per hour.

You'll also want to decide if a trailer-style portable mill is preferable to a ground-based unit that's usually brought to the sawing site in the back of a pickup truck and then set up near your log pile. A trailer-mount portable sawmill is faster and easier to set up, but it poses the disadvantage of having to lift or roll the logs onto an elevated deck instead of working at ground level. One final advantage to ground units is that they allow multiple sections of tract to be bolted together for sawing long timbers, which is helpful in post-and-beam construction as well as making long, two-sided cabin logs.

Attending a local agricultural fair is a great way to see portable sawmills in action and learn more about the relative advantages and disadvantages of each model. One important consideration will be the size of the wood you'd like to saw, which should be matched to the capacity of your sawmill. Inevitably, many sawmill owners try to make do with a smaller sawmill — a decision they regret as soon as they realize the tree they just felled is too big for their new mill.



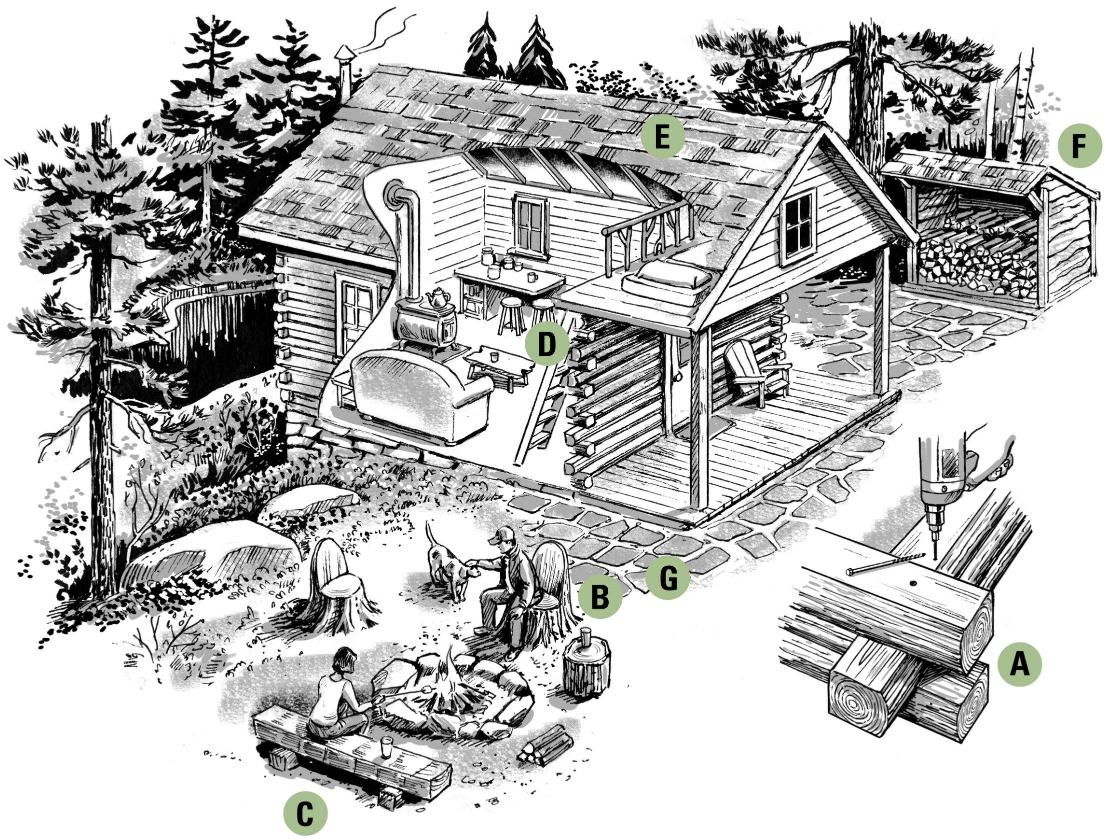
ABOVE: *A trailer-mounted portable sawmill offers the benefit of fast, on-site setup, but loading the logs can be more of a challenge than with a ground-mounted sawmill.*

CRUISING YOUR LUMBER LOT

Making the most of your portable sawmill begins in the woodlot. One of the most challenging elements of developing your woodland eye is the ability to imagine what a standing tree will look like as a log and eventually as a stack of boards. This is especially relevant if you're the one harvesting the trees prior to milling. This direct relationship with both log and lumber presents the opportunity to minimize waste and increase efficiency. Furthermore, keeping a well-tuned mill and remembering a few simple tips for dealing with difficult logs will make your portable sawmilling experience more profitable and pleasurable.

Cut with a product or purpose in mind. Most portable sawmill owners produce lumber for a specific project. Having a specification list both in the woodlot when felling and at the mill will promote greater efficiency by allowing you to buck to specific, usable lengths and diameters. In general, cutting as short a log as possible (while making sure it's still long enough to meet your needs) will minimize waste, a function of less total taper and less crook or sweep. Also, remember that muddy logs will dull your blade in a hurry. If you live in an area with snow cover, skidding in winter not only keeps logs cleaner but also prevents erosion by keeping groundcover intact.

A HOMESTEAD IN (AND FROM) THE WOODS



ABOVE: *Double-tap the image to open to fill the screen. Use the two-finger pinch-out method to zoom in. (These features are available on most e-readers.)*

A: Using three-sided logs with lag screws is a fast and economical way to build a log cabin. Insert rubber weather stripping between each course of logs to seal air gaps.

B: When clearing your cabin site, consider leaving several strategically placed tall stumps that can be carved into camp chairs.

C: Slab wood and log-end trimmings make for a functional and attractive bench.

D: Untrimmed boards with a "live edge" make for rustic coffee tables.

E: Cedar shakes for the roof were split with a froe (see **Making Shakes**).

F: This woodshed was built using "brainstorm" siding. It adds a rustic appearance and also saves on labor, since only one edge is trimmed.

G: When you're building your woodland homestead, be on the lookout for good stones. Make piles for different types (flat, round, and so on), which can be used for a variety of projects, including a practical stone patio that keeps your feet out of the mud.

Think of your woodlot as your lumberyard. A preliminary inventory of your woodlot and a clear harvesting plan will also afford the opportunity to match the trees in your forest with your particular needs. The illustration **here** shows a one-room hunting cabin built using my portable sawmill. Initially, the plan was to use 8" × 8" logs, milled on three sides. An inventory of the woodlot revealed an average diameter at breast height (DBH) of only 10 inches.

Once taper and sweep were accounted for, it became clear that using 8" × 8" logs wasn't possible since most of the 10-inch DBH logs tapered to 6- to 7-inch diameter at the small end. Instead, I revised the plan to use logs milled to 6" × 6". In addition to promoting greater utilization of the trees in the woodlot, it also allowed for more efficient sawing by slabbing off 2" × 6" boards for rafters while milling the cabin logs. This not only minimized waste but also increased production efficiency. In the end, the total construction cost for this cabin was less than $600, showing that even small woodlots can be rich in value.

Cut low stumps. Up to 80 percent of a tree's value can be captured in the butt log (the log taken from the base of the tree). This is a function not only of the volume found in this first log but also of the grade or quality of the log, which tends to be higher because it has fewer knots than the rest of the tree. This means that a board foot of wood toward the butt of the tree is worth more than a board foot farther up the trunk. This increase in volume and value is almost always justifiable, even if it means shoveling snow away from the stump in winter.

Take advantage of unique logs. While commercial loggers are often forced to work within strict industry specifications, the woodland homesteader can take advantage of logs that would normally be left behind. These include logs with a high degree of sweep for specialty applications, such as a curved headboard, or curved stringers for an arched bridge. Even short slabs sawn from the root flares of butt logs have niche markets as artisanal cutting boards.

MAINTAINING A WELL-TUNED MILL

Keep it sharp. The foundation of a well-tuned portable sawmill is a sharp blade. There is a dangerous and costly tendency to try to get “just one more board” out of a dull blade. Here’s a common scenario: You push a dull blade just a bit harder to get it into the wood; because it’s dull you find it diving and rising, making your board thick and thin. Then, just when you think you’ll make it to the end, the blade pops off, now deeply lodged in the log. At this point you take out your chainsaw and cut off the half-sawn board to release the stuck blade. You can avoid this scenario by keeping your blade sharp. Pay attention to how the mill is cutting; if you have to tighten the blade frequently, it’s probably an indication that the blade is dull (dull blades create friction, resulting in a hot blade that expands).

Make sure your logs are clean and free of foreign objects. If you have access to a garden hose near your milling site, wash the logs and remove any loose bark. If your logs are particularly dirty or if you don’t have access to a hose, consider taking the time to peel the bark with an axe or a drawshave. The only thing that will dull your blade faster than sawing through dirt is hitting a metal object in a log. This is particularly common for yard trees, in which nails, old clothesline hooks, and fence wires are often hidden within the slab layer of the log. A metal detector will quickly pay for itself in terms of both time and blades saved.

Keep a maintenance log. The beauty of portable sawmills is that they are relatively simple to operate. Fortunately, they're equally easy to maintain. I've adopted a maintenance schedule, based on the manufacturer's specifications, that works well for my mill. I keep a log of all maintenance activities in a waterproof notepad tucked in the glove compartment of the truck that I use to move the mill. Prior to each use, I inspect the entire mill for loose components. I also check the blade sharpness and tension as well as all fluids. If your mill is equipped with a water tank for lubricating the blade and you intend to run the mill in subfreezing conditions, switch to using cold-weather windshield washer fluid as a winter lubricant.

If you're milling softwoods, be particularly aware of the problems that can be created by pitch. When milling balsam fir, for example, I clean the carriage rails with a lubricant and putty knife every 8 to 10 logs — it's amazing how much built-up pitch and sawdust can contribute to uneven or inaccurate cuts.

Other maintenance items include lubricating drive chains, flushing hydraulic systems to prevent corrosion, and packing wheel bearings, especially after the mill has sat idle for extended periods of time.

CUTTING TO MAXIMIZE YIELD

Given that no two logs are identical, it's fair to say that for every sawing rule, there are at least two exceptions. Assuming a relatively defect-free log, begin by taking a slab off the top of the log, followed by a board or two, depending on what type of lumber you're making. Next, rotate the log 180 degrees so that the newly created flat side rests on the carriage, and remove a slab and board as you did on the first side. Then, rotate the log 90 degrees and repeat the same process on both the third and fourth sides. Once you have a cant (squared timber), you can begin sawing boards off opposite sides.

Milling Crooked Logs

Crooked logs present several challenges. From a quality standpoint, logs with sweep or a crook bring low-grade heartwood defect to the surface sooner with each successive cut than straight logs do. The result is either narrow or short low-grade boards with concave or convex faces instead of the long, wide boards that can be milled from straight logs. The most efficient way to saw logs with a crook or sweep is to first place the log on the carriage with the ears (the flared ends) up. Remove the ears and continue sawing until you have a flat face. Next, rotate the log 180 degrees and remove the sweep slab (hump). Then rotate the log 90 degrees and continue to saw boards normally.

Efficient Edging

No matter how you open up your logs, you'll be left with flitches (bark-edged or "live-edged" boards) that you'll want to finish. If you're sawing a large amount of wood, it makes sense to separate the flitches into piles based on their approximate width to minimize waste. Once the cants have been sawn, place these boards in a stack, edge-up on the carriage; saw one side; and then saw the other. If you have just a few boards to edge, you can place them back on the carriage after you've formed a cant but before you begin slabbing the cant. This way you're able to edge boards and slab boards off the cant in a single pass.

Operating a portable sawmill can be rewarding, particularly when you can take credit for bringing the wood from forest to finished product. By practicing wise felling and bucking techniques, performing preventive maintenance on your mill, and studying efficient milling methods, you'll find that portable sawmills are a practical and potentially profitable forest enterprise.

CHAPTER 3

Animals in the Forest

From Stumps to Greener Pastures

Mention to a forester that you're considering integrating animals into your woodlot and you'll likely receive a look of disapproval, a judgment that is rooted in unmanaged grazing practices of yesteryear. Historically, woodland grazing has been a default practice for farmers unconcerned or unaware of the ecological consequences of casting livestock into the forest with free rein. Not surprisingly, unmanaged woodland grazing commonly led to the degradation of the forest, through soil compaction, elimination of regeneration, and water pollution. However, thanks to a more complete understanding of forests, forage, and livestock management, animals can be integrated into the forest ecosystem and actually contribute to its health. In this chapter we'll explore options for integrating livestock into your woodlot for a variety of purposes, ranging from stump removal to controlled grazing of understory plants.

SILVOPASTURE

Broadly, the intentional combining of agriculture and forestry to create a sustainable and integrated multiuse system is known as agroforestry. This chapter will primarily examine an agroforestry system known as silvopasture, which combines livestock, trees, and forage production on the same acreage —

an arrangement that's well in line with the ambitions of many homesteaders.

Much of the commonly available information on this topic addresses silvopastures in the context of taking open land and planting trees. In this chapter we'll focus on converting a forgotten woodlot to a productive and well-managed pasture system. One obvious advantage of going from forest to silvopasture, instead of pasture to forest, is that your crop trees already exist. One disadvantage is that you'll have to contend with brush and, potentially, stump removal in an effort to create a hospitable environment for growing forage. As with most homestead projects, the gratification associated with creating silvopastures is not instantaneous. In my case, I opted for making the conversion using as few inputs as possible and looked to employ my livestock along the way.

ABOVE: *Through careful management, silvopasture combines livestock, trees, and forage production on the same land.*

PASTURE OR SILVOPASTURE?

To begin, you'll want to ask if a silvopastoral system is right for you. The diversified benefits associated with silvopasture also pose a trade-off in terms of maximizing efficiency. Since the number of trees in a silvopasture is a fraction of the number in a forest, wood production is reduced. Pasture forage, too, may be reduced, since the shade cast by trees means slower forage growth than would be found in an open pasture. However, in many cases the benefits of being able to integrate livestock while producing tree-based crops outweigh the costs.

As is true for any other management activity, assessing the appropriateness of a silvopastoral system begins with an inventory. Silvopasture trees can be grown for a variety of purposes, including timber, firewood, fruit, nuts, syrup, and Christmas trees, just to name a few. Your inventory will tell you what potential "crops" you have. Remember, the easiest trees to grow are the trees you already have.

In some cases, the tree species growing on your property may not be suitable for use in a silvopasture. On my own property, I elected to create a silvopasture in one area and a traditional pasture in another area, based on the shallow rooting behavior of the balsam fir that predominated in what is now the open pastureland. Had I retained the modest density of trees required to constitute a silvopasture, I would have ended up with a pickup-sticks mess after the first heavy winds, since balsam fir depends on dense, touching crowns for vertical stability. In addition to root stability, another important factor to consider is shade tolerance. When shade-tolerant species are released from neighboring tree crowns that provide shade, the released tree can suffer sunscald or other forms of stress that may result in mortality. Unlike shallow rooting, the stress associated with release can be mitigated by releasing the tree over multiple growing seasons. If the tree species or forest condition isn't conducive to a silvopasture arrangement, you may want to consider clearing the land to use as traditional pasture but incorporating other agroforestry techniques such as windbreaks or riparian buffers.

You may also discover that your potential silvopasture doesn't have a single crop but instead has multiple crops, based on the species that exist. This could mean that your silvopasture is a source for apples, maple syrup, and firewood — a combination that is more common than you'd imagine. As important as the tree crops are the livestock species you select. They should match your silvopasture in both scale and forage type.

REASONS TO CONSIDER SILVOPASTORAL SYSTEMS

Beyond the obvious benefit of being able to harvest both forest and agricultural products from the same land, silvopastoral systems offer less-recognized benefits that promote sustainability and make your homestead more productive. These include:

Growing more food without more land. As populations grow, demand for food will also increase. Neglected woodlots and forgotten forests present the opportunity for crafting a productive working landscape that's capable of yielding a variety of products simultaneously. In addition, modern, portable fencing systems enable small-scale growers to better control the location and duration of grazing, which increases productivity and reduces feed costs while ensuring that no particular plot is overgrazed.

Promoting heritage breeds of livestock. Burgeoning interest in heritage breed livestock is well matched with the browse and forage conditions that are often created in silvopastures. Unlike factory farm livestock, which is bred for rapid growth based on a strictly controlled diet, heritage breed livestock has the ability to thrive in the diverse forage conditions representative of silvopastures.

Controlling invasive plants. Lack of competition from other plants or from animals is one of the primary reasons invasive plants are able to establish themselves and dominate fields and forests. Fortunately, with controlled silvopasture grazing, many invasive species can be kept in check and serve as livestock forage. This dual benefit of forage and land restoration represents an attractive alternative to invasive plant control that often relies on labor-intensive hand-pulling of individual plants or the use of potentially harmful herbicides.

Improving animal health. Research continues to show significant health benefits associated with silvopastoral arrangements. The shade provided by silvopastures in summer leads to greater animal comfort, which means animals graze longer and potentially grow faster. For lactating goats, summer shade, versus a traditional open pasture, has been shown to increase milk production by 10 percent. Additionally, since silvopastures often represent a less-homogeneous landscape, greater plant diversity is available for grazers, thereby providing a more diverse and potentially better balanced diet. That said, realize that some plants may be harmful to particular livestock; take the time to inventory and research any questionable plants before allowing your animals to browse or graze.

Taking advantage of free labor. Like children, livestock can be either a productive asset or a grocery-burning burden. Consider how you can use your livestock to create and maintain silvopastures. From plant control to stump removal and fertilization, it's important to manage your livestock in a way that minimizes costs while maximizing benefits. For example, free range poultry can be deployed to a winter pasture in early spring to break down cow patties. At the same time, the chickens are controlling parasites and reducing their own feed bill.

MARKING YOUR SILVOPASTURE

Once you've decided to convert your neglected woods to a silvopasture, you'll need to mark the crop trees that you'll maintain for future use. The considerations when marking crop trees include species, form/health, and spacing. If you're looking for ideas on how to use various species (especially coppice species), consult the tables **here** and **here**.

The stocking level of your silvopasture will vary depending on your objectives, the successional stage of your lot, available crop trees, and other site attributes. Most unmanaged hardwood woodlots have at least 100 square feet of basal area per acre; unmanaged softwood or coniferous woodlots often have around 220 square feet of basal area per acre. Obviously, these numbers will differ significantly according to location and forest type, but they at least provide a useful starting point to tell you what proportion of the stand you're likely to have to remove to meet your target density in the silvopasture.

Top Three Requirements for Silvopastures

Water. Is there a source nearby, or will you have to truck in water?

Access. Is there a trail or woods road leading to your silvopasture? Isolated silvopastures can quickly become a headache, particularly if you have to truck water or don't have an easy way to move livestock in or out.

Fencing. Can the area be easily fenced? Is there an adjacent fenceline that can be used to minimize fencing costs? Is a permanent fence necessary, or is portable electric fencing an option?

You can mark your crop trees with flagging or tree-marking paint. The advantage to using temporary flagging is that once you’re done with the preliminary establishment of your silvopasture, you can remove the flags. If you’re unsure whether a tree should be retained as a crop tree, err on the side of caution and save it; you can always remove it later. Another approach is to remove competition trees over time, slowly creating your silvopasture and allowing your crop trees to adjust to new light conditions.

As you mark your stand for crop trees, pay attention to spacing. This is important not just for your crop trees but also for the forage grown below. If there’s inadequate light at ground level, establishing a silvopasture will be impossible.

In addition to creating semi-even spacing of trees, you must also consider the structure of the forest. As you may recall from **chapter 1**, “structure” refers to the proportion of small trees to large trees. The successional stage of your forest, as well as its history, largely determines your forest’s structure. Larger trees will cast larger shadows, providing more shade. Smaller trees may provide less shade, but if they have low, sprawling crowns, it may prevent the establishment of forage below. The trick is to strike a balance between light and cover.

You must also consider the balance of light and cover in the context of your target forage species. At this point you may not know what that target forage species is. Your immediate goal may be to control an invasive species, but ultimately you’ll want to transition to growing, through either natural establishment or seeding, dependable noninvasive forage that is palatable to your specific livestock. Understanding your soil conditions as well as regionally appropriate forage types is essential. Your local Cooperative Extension office will be able to assist with soil testing and to suggest forage types.

EXPERT PROFILE

North Branch Farm

Joe Orefice

The young-farmer movement brings new energy and innovations to small-scale agriculture. One of these young farmers, Joe Orefice of North Branch Farm in Saranac, New York, is leading the charge to change the way people view woodlots and forest lands. Citing the ever-increasing demand for food and the burgeoning interest in local food, Joe is using his farm as a living laboratory to study how marginal woodlands can be converted to silvopastures capable of producing a variety of goods.

Joe uses Scottish Highland, Belted Galloway, Holstein, and Hereford cattle in his silvopastures, noting that the heritage breed cattle are his best browsers. Over his 75-acre property, Joe has several silvopasture areas that provide firewood, timber for projects around the farm, and wild apples for cidermaking.

Key to the success of Joe's silvopastoral system is an intensive rotational grazing program. Using a portable, single-strand electric fence system, Joe moves his cattle every few days, never letting the forage drop below 3 inches in height. The paddocks are fairly small, typically ½ acre or less.

Prior to the establishment of silvopastures, the property was overgrown with woody shrubs and had largely succumbed to old-field succession. Within a year of introducing cattle, aggressive browsing had knocked back undesirable species to a more manageable level.

THE CLOSED-LOOP SILVOPASTURE SEQUENCE

Now that we've outlined the general requirements for establishing a silvopasture, let's discuss how you can create silvopastures using minimal inputs and livestock you already own. While my experience is unique to the species and conditions found on my homestead in northern New York, the process can be replicated under a variety of conditions.

When I purchased what is now my homestead, it was a mix of abandoned potato fields that had succumbed to old-field succession and a forgotten Christmas tree plantation that was more than 40 years old. With the help of a willing horse and a portable sawmill, I turned the forgotten forest into a lumberyard for virtually every homestead project. However, it quickly became clear that if I wanted to expand and diversify the livestock on my property without going broke from buying feed, I'd need to integrate livestock through a silvopastoral system.

DEFINING THE AREA

Since the property was once cultivated, I had the benefit of using old stone walls as a guide for establishing the silvopasture location. I knew that I wanted it close enough to the house that it was convenient but far enough away that I didn't feel like I was living in a barnyard. An inventory of the site showed that the old Christmas tree plantation had nearly 260 square feet of basal area per acre! Had the trees not been planted in rows, it would have been impenetrable.

Balsam fir is a short-lived, shallow-rooted species, so I knew it wasn't a very good candidate for silvopasture. However, there were several gaps in the old plantation, a result of windfall, that had allowed white pine, black cherry, and gray birch to establish. The sandy soil proved ideal for the white pine, which despite only being about 30 years old was already nearly a foot in diameter. The black cherry and gray birch both had multiple coppice stems as a result of browsing by deer and rabbits.

With livestock on the way, I made the decision to fence the perimeter of the silvopasture first and then employ the animals in clearing the rest of the land. Most of the fenceline clearing took place in late fall, which gave me the opportunity to barter balsam boughs (for wreath making) in exchange for cedar fenceposts and use of a tow-behind wood chipper. As I cleared the fenceline, I deposited the wood chips in a thick bed on the outside, to prevent vegetation from establishing and thereby discourage livestock (particularly sheep) from pushing on the fence to reach forage on the other side. Eventually, I carved a 30-foot-wide swath in the footprint of the proposed fenceline. At the time many folks questioned the wide swath, but it ensured adequate room for drilling post holes and rolling out fence. Additionally, the wide swath meant that falling trees wouldn't be in striking range of the fence. I used woven wire as the fence material, since I planned to use multiple species for grazing — from chickens to cattle. Later, I used electric polywire fence to create movable, internal grazing paddocks.

THINNING YOUR SILVOPASTURE

In the context of creating silvopastures, the goal of thinning is to reduce tree density to a level that allows for vigorous forage development in the understory while retaining as many trees in the overstory as possible. One reason this arrangement works is that trees and forage plants obtain their required inputs from different areas; trees get their water deeper in the soil and use direct sunlight, while ground forage plants rely on water closer to the surface and can maintain growth even under diffuse light conditions.

It is also important to understand how light is manipulated by both crown shape and species. While conifers generally create less shade, because of their conical shape, the shade that they do create tends to be heavy and can often prevent the successful establishment of ground forage. Leaf size, density, and arrangement also influence shade. Beech and maple, for example, cast heavy shade, while locust and tamarack generally have less-dense crowns, allowing for more light penetration.

While commercial-scale thinning using large machines may be appropriate for large-scale silvopastures, most homesteaders would be well served to develop their silvopasture area on their own, using low-impact tools and techniques. In my own silvopasture, I retained approximately 50 trees per acre in the initial thinning and removed another 20 trees per acre the subsequent year to prevent thinning shock.

Perhaps one of the most important considerations in doing this work is to remember that you're thinning to create an ideal environment for your crop trees. That means that you should take the utmost care to reduce residual stand damage, both to your trees and to the soil below (see box, below).

Tips For Reducing Residual Stand Damage

- Make sure crop trees are clearly marked to avoid unintentional damage.
- Use directional felling methods in which trees are felled into a gap, avoiding contact with the crowns of other trees.
- When skidding, never allow a log to rub up against your crop trees. This creates a basal scar, which is an entry point for insects and disease. Instead, roll the log away from the tree using a peavey.
- Avoid working in muddy conditions. Not only does mud make your time in the woodlot less productive and enjoyable, but it also creates soil compaction, which damages tree roots and forage.

PRE-THINNING

In creating my own silvopasture, I used Scottish Highland cattle and Scottish Blackface sheep to conduct a pre-thinning within the proposed silvopasture. The purpose of the pre-thinning was to make the site more accessible for the actual thinning operation. Within a week, the cattle had used their horns to successfully “prune” the dead boughs from nearly every tree over 2 acres. The sheep aggressively browsed the witch hobble (*Viburnum lantanoides*) and lowbush blueberry (*Vaccinium angustifolium*) that predominated the understory.

With the pre-thinning complete, I was then able to begin the actual thinning operation. I chose to begin at the interior perimeter of the fence (where I had previously cleared an alleyway), working my way toward the center. This systematic approach was fast and efficient. Over the three months that it took to thin the silvopasture, I used a variety of harvesting tools and techniques, including horses, an ATV, and a compact 4×4 tractor with a logging winch. Each method offered advantages and disadvantages, with efficiency seeming to be inversely proportional to enjoyment. Using the horses was certainly the slowest, but the pleasant nostalgia of knowing homesteaders a century earlier had used the same techniques on the same land made the hard work worth it. With winter closing in and still in need of more firewood, I finished skidding logs with the tractor, which was able to haul twice as much wood with each trip.

I removed boughs from several white pine and Scots pine trees for spacing purposes, and placed them in a windrow for the cattle and sheep to browse. Despite having an ample supply of hay and a mineral lick, both the sheep and the cattle showed a keen interest, if not a preference, for the boughs. (It's worth mentioning that during the thinning process, I moved the livestock to an adjacent pasture, given the obvious risks while felling trees.)

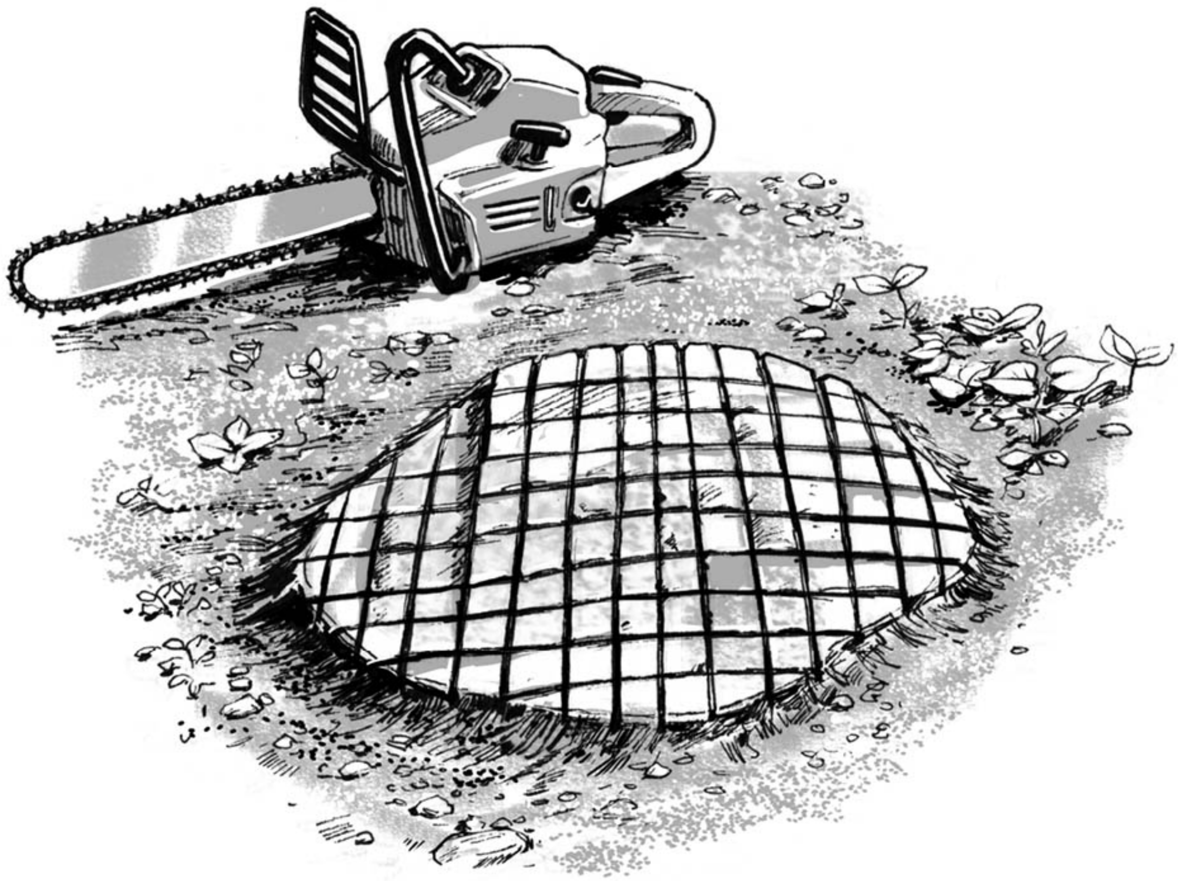
Logs from the thinning operation were sorted into three piles. I retained the largest and straightest trees for building a guest cabin on the property, bartered the smaller-diameter softwood with a neighbor for labor, and reserved the firewood for my winter heating supply.

STICKS AND STUMPS

Once you begin thinning, you'll be amazed by the volume of brush you create. If this brush is palatable to your animals, you may consider matching the rate at which you thin to the rate at which your animals are willing to consume the browse.

Another option, assuming local laws allow, is to burn the brush — an effective way of returning nutrients to the soil and increasing pH for forage that needs alkaline soil. Ideally, you should allow your brush to dry for a year. Attempting to burn green brush will make for a smoky mess that does little to win over the neighbors. Also, instead of having one giant brushfire, you can build a series of smaller piles over stumps you wish to remove. Like the brush, these stumps will burn much better if given a year or two to dry. As a cautionary note, realize that if the conditions aren't right (too dry, for example), stumps can smolder underground. For that reason, I do most of my stump burning in early spring when the ground is fully saturated with water.

Another option for stumps is simply to let them rot. Many people assume that stump removal creates more space for growing forage, but in reality it is a significant time investment that's tough to justify simply from the standpoint of increasing forage. One way to expedite stump rot is to cut stumps as low to the ground as possible and use the attack corner of your chainsaw bar to carve a grid pattern in the stump. This grid will hold water and debris, thereby encouraging decomposition and allowing a splitting wedge to be inserted a year or two down the road to split the stump apart.



ABOVE: *Cutting stumps low and carving a grid pattern in the top will expedite decay.*

Another alternative to removing stumps is to use them as a forage source. (See **here** for more on the creation and use of stump and root suckers as a forage material.) In my case, the only stumps I intentionally retained for forage were those from gray birches. I removed the black cherry stumps immediately, because of the potential toxicity of wilted cherry leaves to livestock. Since fir and pine stumps don't sprout, I removed them. They not only took away from productive growing space but also prevented mowing, which was an important part of allowing more desirable forage species to establish. Of all the stump removal methods I explored, it was the venerable "pig-o-tiller" that proved most successful.

PORK POWER FOR STUMPS AND SOIL

If the local farm store were to sell a "build your own silvopasture" kit, no doubt it would include a pair of pigs. A pig's snout shares a remarkable resemblance to a chisel plow: strong, stout, and slightly curved on the end. It is this snout, in concert with an olfactory curiosity, that makes pigs ideal for rooting up unwanted stumps while preparing the seedbed for forage.

Pigs do their best work in a competitive environment. A solitary pig won't feel a sense of competition at the feed trough and will likely do more sleeping than eating. A pair of pigs, however, represents a powerful team capable of turning soil and freeing stumps. But be careful: letting a pair of pigs have free rein of your homestead is a recipe for disaster. Instead, you must focus your pigs, giving them a task that's linked to a tasty reward. The key to making this work is a custom-built pig-o-tiller.

The pig-o-tiller is a glorified manger or loafing shed that focuses the pig on the purpose of stump removal and tilling your soil. (See instructions on how to build one **here**.) It's important that the pig-o-tiller be large enough that your animals are comfortable but not so large that they lose sight of the task at hand. The trick is to use a bit of grain to entice them into working. To do this, select a stump you'd like to remove and use a rock bar (a heavy steel pry bar) to create a series of 12- to 18-inch-deep holes around the base. Next, pour cracked corn down each of the holes. Pull the pig-o-tiller over the stump and let the pigs go to town! In my experience, a pair of pigs was able to excavate a 10-inch stump in about two days. Whenever they didn't excavate deep enough, I'd repeat the process until the stump was excavated to the point at which I could finish pulling it out with a horse or a tractor.

Over the course of a summer, I was able to excavate more than 60 stumps using this method. I moved the pig-o-tiller, by hand, around the new silvopasture in a systematic fashion. Not only were the pigs able to excavate the stumps, but they also turned the duff and exposed mineral soil, which is essential to the germination of many desirable grasses and forbs. Importantly, I never put the pigs within crown distance of my crop trees. To do so would put the shallow roots in danger of being damaged. As a general rule, I never left the pig-o-tiller in one spot longer than five days. This meant that the pigs always had a clean spot to bed down and didn't become bored enough to try Houdini tricks.

ABOVE: *Harnessing porcine power means encouraging rooting in a way that's productive, not destructive. Creating a series of 12- to 18-inch-deep holes around a stump and tossing a handful of grain in each hole makes quick work of a tough job.*

Another thing to consider with a pig-o-tiller is that because the pigs work in a confined area, they must have access to clean water and additional feed. And a final consideration is that the age of the pigs makes a difference: when your pigs are small, they'll be less productive workers, requiring more time to get the job done.

If you wish to pasture your pigs, but without a pig-o-tiller, you may want to consider portable electric fencing. Like the pig-o-tiller, fencing can limit the pigs' range to the area around a stump, and you can use the same tricks to encourage rooting. However, it's extremely important that the pigs are trained on the electric fence from the time they're piglets, and that a large enough energizer is used with the fence. You can choose either a commercially made woven-strand portable electric fence or two strands of electric fence wire strategically placed at 6 and 12 inches above ground level. With either type of fencing, be cautious of pigs using their chisel-like snouts to build a grounding berm that shorts out the fence. Clever critters, eh?

FROM PIG PREP TO SEEDING

I seed my silvopasture incrementally, as soon as the pigs have finished their work removing stumps and turning the soil in a given area. I've used two primary methods: feed seeding and frost seeding.

Feed Seeding

Feed seeding is a good option if you have access to high-quality hay for your livestock. In my case, I feed 4' × 5' round bales that come from a neighboring farm with a mix of quality timothy, orchard grass, and clover. Once the pigs have finished their prep work, I place a bale on the site previously occupied by the pig-o-tiller and let the cattle, horses, and sheep go to town. What they don't realize is that while they're eating, they're also working. The manure they produce is now rich with quality undigested seed that is spread throughout the pasture (and later broken up with a chain harrow). Additionally, the site where I fed them has been subject to hoof action, which creates a depression that's the perfect moist microenvironment for seeds to germinate. What little hay remains behind serves as protective mulch for the seed below. Over the course of a year, I fed hay in a different location every week, ultimately creating a silvopasture that looks as if it were planted with a seeder. However, avoid letting your livestock graze your new forage too early, as it can damage tender roots.

Frost Seeding

Frost seeding relies on Mother Nature, rather than expensive seeding equipment, to do the dirty work. By broadcasting seed during the freeze-thaw cycle of early spring, you're able to take advantage of soil movement that provides good seed-to-soil contact. As ice heaves upward and then contracts, your seed is worked into the soil, thereby eliminating the need for disking or cultipacking. Once temperatures are out of the freezing zone, the seed will begin to germinate.

In my area of northern New York, red clover has worked exceptionally well for frost seeding. Part of the reason is that it's a relatively heavy, round seed that's able to make better soil contact than a lighter, flatter seed. Red clover is also appealing in silvopasture arrangements because it's able to "fix," or release, nitrogen in excess of its own needs, thereby increasing fertility for both trees and ground forage. One of the best ways to ensure successful frost seeding is to "run out," or heavily graze, a pasture in the fall prior to early spring seeding. This helps to increase the chance of soil–seed contact. Despite how basic the process is, it’s not uncommon to have only a 70 percent establishment rate on frost-seeded sites.

If your pasture is small, you can broadcast seed by hand. If you’re frost seeding a larger area, consider using an ATV or a tractor-mounted seeder with rows appropriately spaced to prevent seed overlap or bare patches.

As with the feed seeding method, with frost seeding you can let your livestock help work the seed into the ground by allowing them access to the silvopasture during the freeze-thaw period. After that point, move them to another pasture and allow the seed to fully establish to grazing height.

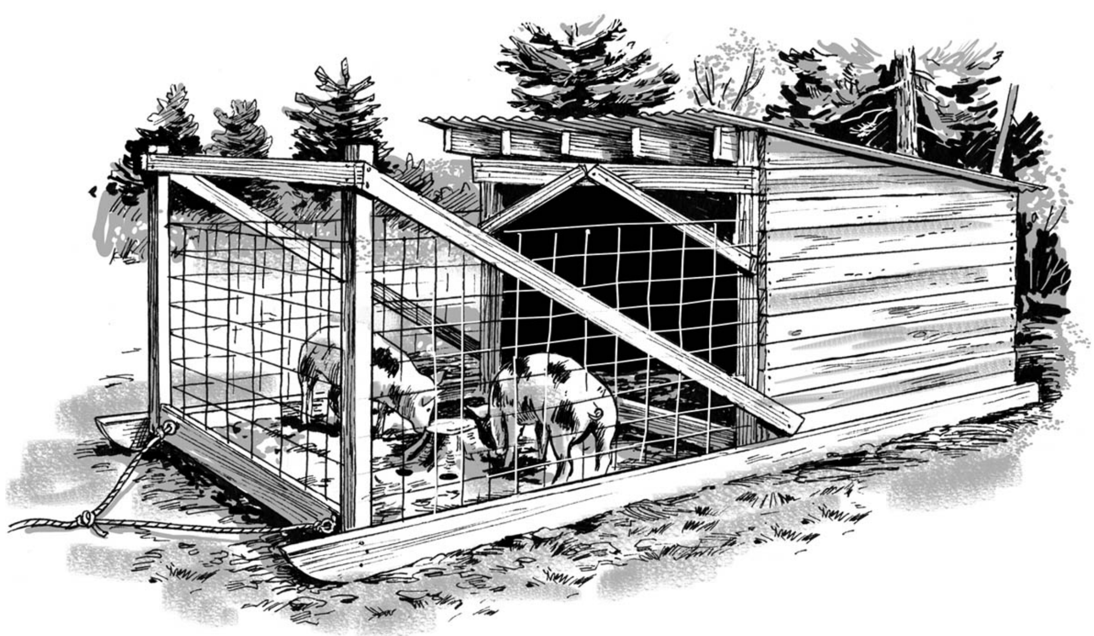
HOW TO BUILD

A Pig-O-Tiller

While lots of options exist for housing pigs, the pig-o-tiller offers a portable alternative that promotes both healthy hogs and pasture improvement. For a pair of pigs, 8' x 11' is ideal, with the option of an additional “pig porch” constructed out of an old hog panel. Because of the stress of being moved, and the fact that pigs have a penchant for scratching on posts, use wood screws instead of nails — they’ll do a better job of holding things together.

1. Start with a pair of 2" × 6" × 12' boards. These will become your skids for the base of your pig-o-tiller. Cut the ends of both boards at a 45-degree angle to make the skid tips.
2. Place the skids on edge 8 feet apart and screw a 2" × 4" × 30" upright on each of the rear corners. Screw two identical uprights on the front of the pig-o-tiller 1 foot back from the front.
3. With your four uprights in place, use either 1-inch rough-cut boards or plywood for the sides. To entirely enclose the pigs, you can board up both ends as well. If you want an open pig porch, simply use a 2" × 4" × 8' board as a brace at the top, and attach the hog panel as shown in the illustration.

4. Cover approximately half of the pig-o-tiller with corrugated roofing. It's a good idea to permanently attach one piece; however, you'll want to have additional pieces that you add or remove, based on the weather.
5. Finally, attach a rope long enough to allow you to drag the structure easily.
6. Lift the front of the pig-o-tiller and prop it with a bucket when you need to let pigs in or out. Unnecessary doors simply invite fugitive behavior.



TAKING STOCK OF LIVESTOCK

The success of your silvopasture will largely be a function of selecting the right livestock and determining the appropriate stocking level for the scale of your homestead. While cattle might not be a practical option for you, smaller livestock may provide the opportunity to integrate silvopasture components on a more manageable scale. This section will examine different livestock options and arrangements suitable for a variety of conditions. Your foremost consideration when introducing your livestock to new forage should be animal health. Take the time to learn what plants are potentially harmful to your animals and eradicate those plant species before allowing livestock entry.

CHICKENS

If you've never raised livestock before, be warned: chickens are the gateway animals that may lead to goats, pigs, and even cattle. Chickens are also a natural choice for the woodland homestead because of their natural foraging abilities. The modern domestic chicken was bred originally from jungle fowl in Southeast Asia. While these early birds were a bit on the scrawny side for a chicken dinner, their hardiness and penchant for staying nearby was the starting point for early breeders, who selected for desirable characteristics such as egg production, meat production, or a combination of the two, making for dual-purpose birds.

ABOVE: *Chickens are a great way to control pests while effectively adding nitrogen, phosphorus, and potassium to your soil.*

Chicken Tractors

Chickens can contribute more than just eggs to the woodland homestead. Shortly after I completed my silvopasture, a soil test revealed extremely low levels of nitrogen. Not wanting to use synthetic fertilizers, I headed to the chicken coop to call in the poultry crew. While you could allow your chickens to simply free-range in your silvopasture, it's better to confine their activity if you're in need of a major nitrogen boost. To do this, consider using a chicken tractor, a movable floorless chicken coop (with or without wheels) that you can pull from one location to the next. By moving the chicken tractor daily, you'll be constantly providing your poultry with a fresh salad bar. When chickens are on fresh grass, you'll find that they consume about one-third less feed than when natural forage isn't available.

While using a chicken tractor is an effective way to add nitrogen, phosphorus, and potassium to your soil, you may also choose to simply allow your chickens to range freely in your woodlot or silvopasture. If you allow your birds to free-range, be aware that unthinned forests with thick undergrowth make good hiding places for predators such as foxes and weasels. For that reason, you should always return your chickens to a secure coop for the night. Usually, chickens will retreat to the coop on their own; however, if you find your birds roosting in your silvopasture or woodlot for the evening, consider adding a late-afternoon snack of cracked corn back at the coop. This incentive is usually enough to change their evening behavior.

HERITAGE BREED CHICKENS FOR THE WOODLAND HOMESTEAD

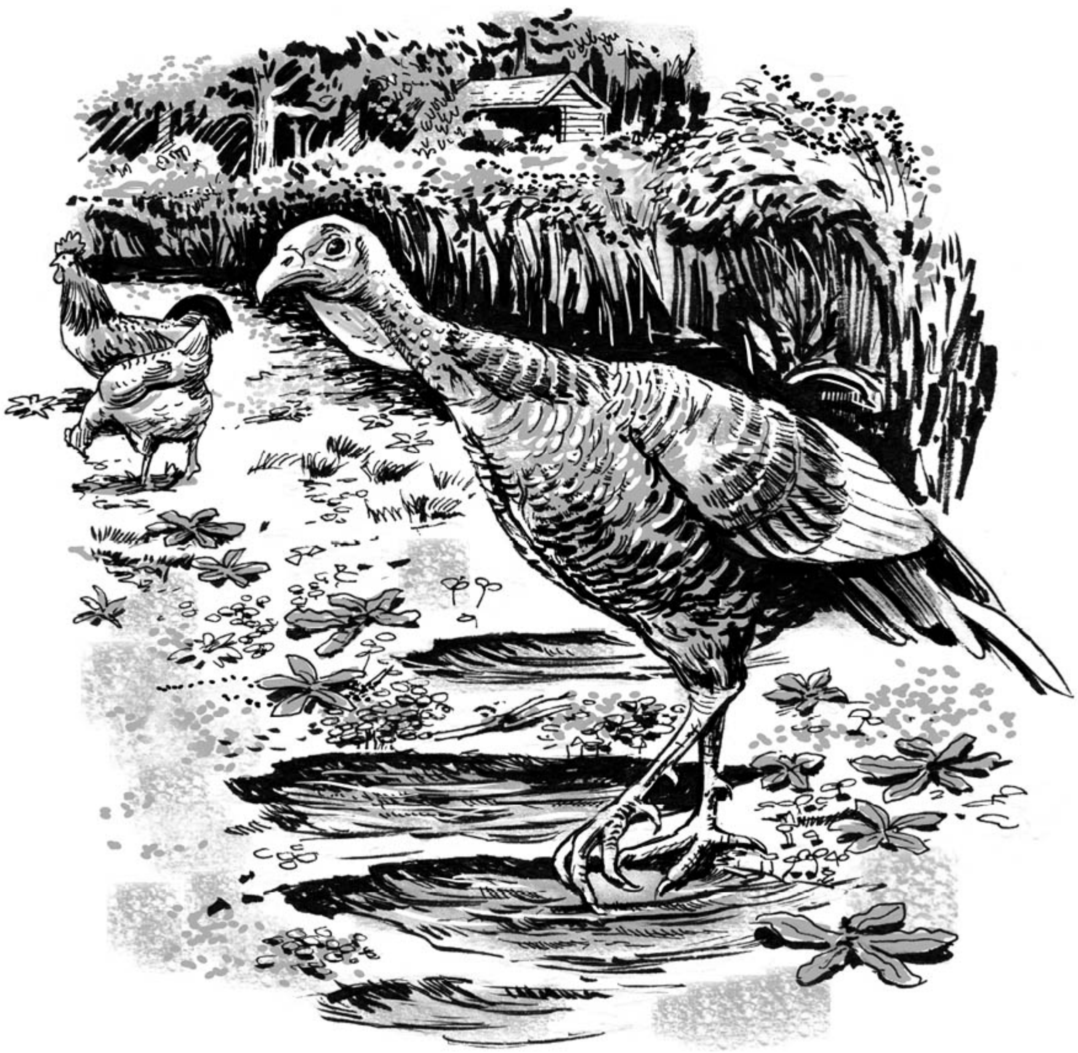
Breed	Purpose	Woodland Foraging Ability	Climate Requirements
Ameraucana	Dual-purpose	Fair/good	Hardy
Ancona	Eggs	Outstanding	Hardy
Australorp	Dual-purpose	Good	Cold tolerant
Leghorn	Eggs	Good	Heat tolerant
Minorca	Dual-purpose	Outstanding	Heat tolerant
Orpington	Dual-purpose	Good	Cold tolerant
Red Ranger	Meat	Good	Hardy
Rhode Island Red	Dual-purpose	Good	Temperate/hardy
Welsummer	Dual-purpose	Outstanding	Cold tolerant

TURKEYS

Pound for pound, few other animals are as useful on the woodland homestead as turkeys are. With a bit of careful management, turkeys can save you both time and money. In fact, turkeys that are raised using the forest and pasture methods described in this section will consume, on average, 25 percent less feed than turkeys raised in confinement. They'll also be healthier because of their access to open space and uncontaminated living conditions.

Using Turkeys for Woodlot Scarification

One way to integrate domestic turkeys into the woodland homestead is to have them mimic the action of wild turkeys, which play an important role in the regeneration of some tree species. In stumbling upon the work of wild turkeys, you'll likely find a patch of forest floor that looks like it's been raked or harrowed. In an effort to find worms, grubs, nuts, and fungi, turkeys will scratch the leaf litter, ultimately exposing mineral soil. This soil disturbance, known as scarification, creates an ideal seedbed for germination. Using domestic turkeys to scarify your woodlot is a great way to encourage regeneration of trees from seed. Preferably, scarification should be carried out in late fall to create ideal spring germination conditions.



ABOVE: *Turkeys can encourage the establishment of many desirable tree species by scarifying mineral soil, thereby promoting seed germination.*

Woodlot scarification to promote seed germination of trees must be judiciously monitored to prevent soil damage and preserve seed stock. If your turkeys are allowed to graze too long in an area that is too small, they'll compact the soil and decimate your seed bank (an inconspicuous, multigenerational collection of seeds tucked neatly beneath the soil, just waiting for the perfect opportunity to germinate). One way to preserve this important resource is to establish a rotational scarification system, in which a portable turkey coop is located in the center of the woodlot, with a series of pie-shaped paddocks that radiate outward from it. This will allow you to rotate the turkeys to the next paddock for scarification without having to move the coop. To encourage scarification with domestic turkeys, broadcast cracked corn in the area you wish to have scarified.

Heritage breed turkeys are naturally good foragers, so using them for scarification means you'll also save money on your feed bill. However, because heritage breeds haven't been bred to grow excessively large, like commercial breeds have been, many of them can fly or at least roost several feet above the ground. Bearing in mind the breed and its flight abilities is important if your goal is to use your birds in a paddock fence system. Another option for managing freedom-loving turkeys is to use a turkey tractor (essentially just an oversize chicken tractor) to prevent flight.

The Red Roost Inn

Few homestead projects are as rewarding as building your own chicken coop and coop accoutrements (nest boxes, perches, and feeders) from materials that you've harvested on your woodland homestead.

I built the Red Roost Inn, an 8' × 8' log chicken chalet, with less than $10 of purchased materials. The 6" × 6" pine logs were harvested as part of a silvopasture thinning operation, and the roof is made of tin sheets once used to ship painted metal roofing. The lumber for the nest boxes was cut on the portable sawmill, and perches were constructed out of branches that were pruned as part of a tending operation. I made the chicken feeder from a piece of coppice firewood by cutting a V groove down the center. The bottom of the feeder is kept round to discourage the chickens from trying to perch on it.

Grazing Turkeys in the Silvopasture

Turkeys can also be grazed in pasture and silvopasture arrangements — however, for a slightly different purpose. As in the forest, turkeys will be able to forage up to 25 percent of their diet on good pasture. To raise two dozen turkeys you'll need at least half an acre of good pasture, such as clover. Turkeys have a fairly narrow grazing height range: no shorter than 1 inch and no higher than 5 inches. Consider multispecies grazing as a means of keeping forage height in check; for example, you can follow turkeys with sheep, which are known for maintaining an even grazing height.

As with chickens, keeping predators away from turkeys can be a challenge. Young turkeys, or poults, can begin grazing as early as eight weeks, but they need extra protection from predators at this age. Most predators of poults will come from above: owls at night, hawks and eagles during the day. The best way to protect young birds is to use a fully contained poultry tractor. For terrestrial predators, using an electrified portable paddock fence inside the main pasture or silvopasture offers an extra measure of protection. As with chickens, turkeys should be kept in the coop at night.

HERITAGE BREED TURKEYS FOR THE WOODLAND HOMESTEAD

Breed	Advantages	Disadvantages
Black	Calm disposition, rapid growth	Relatively uncommon; stock can be difficult to locate
Bourbon Red	Outstanding forager, flavorful meat	Excellent flyer, often roosts in trees
Midget White	Small, a manageable size for the freezer	Excellent flyer, often roosts in trees
Narragansett	Calm disposition, high egg production, good forager	Rare; stock can be difficult to locate
Royal Palm	Small, a manageable size for the freezer	Good flyer, relatively slow growth

GOATS

An old Persian proverb says, “If you have no trouble, buy a goat.” No doubt the mischievous goat has earned its reputation, but it can also earn its keep as a lawn mower, chainsaw, power pruner, cheese maker, or, if things don’t go well, as goat burger. However, let’s not be too presumptuous; you may discover that a goat is the perfect addition to your woodland homestead.

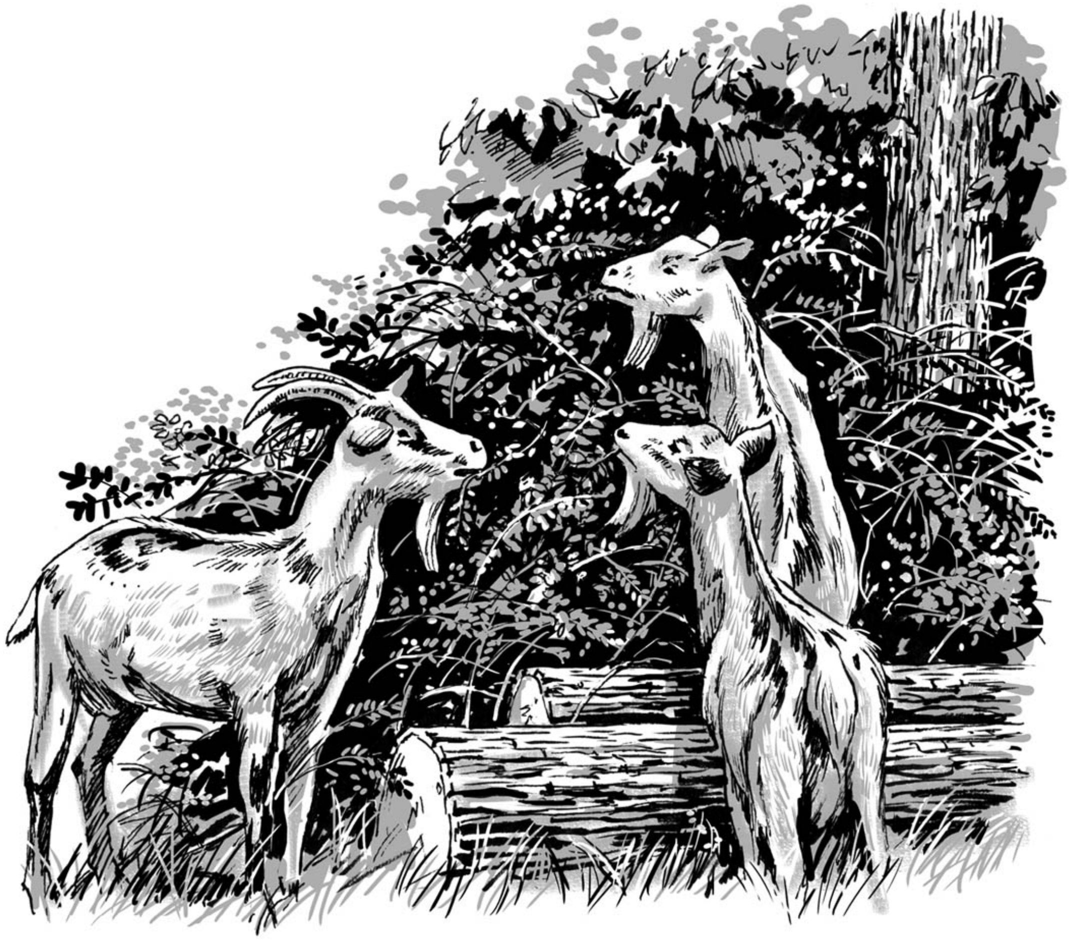
In addition to their versatility, goats are easy keepers, making them ideal for first-time livestock owners. They don’t require elaborate housing, just a place to get out of the weather. A simple protective but well-ventilated shelter should offer at least 15 square feet of space per animal.

Since goats are highly social animals, it’s best to have at least two. If a second goat isn’t feasible, consider other livestock as companions. Horses, donkeys, cows, and sheep have all been effectively integrated as companion animals. In fact, the old expression “to get one’s goat” refers to devious goat snatchers who stole companion goats from favored racehorses, thereby upsetting the horse and ultimately the race.

Goats are known for being curious and willing to try new kinds of feed, which makes them great browsers and grazers. This relatively indiscriminate feeding instinct makes them particularly well suited to purposeful and managed woodland grazing. One woodland homesteader I know put it like this: “I had an easy choice; I could have either purchased an expensive brush mower or a herd of goats that would later provide me with milk, cheese, and fertilizer.”

Goats can be raised for dairy or meat; dual-purpose breeds can be raised for both. In contemplating the choice of breed, you have several important considerations: What is your primary reason for having goats? Is it their utilitarian value as brush mowers? Or is your primary purpose really to produce milk and cheese for your family?

Because of their high nutritional requirements, dairy goats need a higher proportion of commercial feed versus forage than meat goats do. Breeds that are raised for meat can, under optimal forage conditions, thrive with little to no commercial feed. If you decide to employ a dairy or dual-purpose breed in brush clearing, be aware that aromatic browse such as cedar or juniper will make the milk unpalatable. Another consideration in using dairy or dual-purpose goats to browse is that in dense forest, undergrowth can scratch or cut the goat’s udder. In most cases, it’s best to use meat goats in the establishment of your grazing area and then transition to dairy or dual-purpose goats once the grazing area is established.



ABOVE: *Goats are voracious browsers and have earned the reputation of possessing indiscriminate palates that will even tolerate poison ivy and multiflora rose.*

Given that about three-quarters of the cost of keeping goats is in feed, the savings associated with browsing and/or grazing can be significant. Goats allowed to graze and browse are able to select forage based on their own nutritional needs. Research shows that goats raised with the option of either grazing or browsing are less likely to have digestive problems than those raised on grain and other bagged rations.

GOAT BREEDS FOR THE WOODLAND HOMESTEAD

Breed	Size	Primary Purpose	Unique Traits
Alpine	Medium/large	Milk	Common Swiss breed
Sable	Large	Milk	Highly adapted to a variety of climatic conditions
Oberhasli*	Medium	Milk	Known for their exceptionally sweet milk
Nigerian Dwarf*	Small	Milk	Small size makes them ideal for smaller properties
Kinder	Medium	Dual-purpose	Good yield of meat and milk; high butterfat content makes for wonderful cheese
Boer	Large	Meat	Fast growing; high-quality meat; larger size allows for higher browsing
Spanish Goat*	Medium	Meat	Originally brought to North America by Spanish explorers who used these hardy goats for clearing brush
San Clemente*	Small/medium	Meat	Ran feral for nearly a century on San Clemente island off the coast of California; recently (re) domesticated and noted for excellent foraging abilities
Kiko	Medium/large	Meat	Does well on low-quality forage; resistant to many parasites

*Indicates a heritage breed

SHEEP

Contrary to popular belief, sheep are not stupid; they're simply a flock species that's opposed to being herded or separated.

This makes sense, if you consider that their only protection from predators is to band together. If a predator is on the prowl, you can imagine that independence isn't exactly the most desirable trait.

The flocking tendency of sheep is a desirable quality if your goal is to systematically graze a pasture or silvopasture. Unlike goats, sheep are usually content to stay within a fenced area and generally get along well with other livestock. Sheep are particularly versatile, making them ideal for the woodland homestead. Their wool, milk, and meat can all be processed on the homestead, and bartering lamb for more common homestead animals like chickens or pigs is easy.

Grazing Sheep in the Silvopasture

Sheep can play an important role in preventing less-desirable plant species from establishing a stronghold. As a general rule, cows and horses favor grasses, while sheep seek out leafy forbs, including invasive species like tansy (*Tanacetum vulgare*) and spotted knapweed (*Centaurea maculosa*).

Certain breeds of sheep are better suited to the coarse forage generally found in newly established silvopasture arrangements. (See the table on the opposite page.) Livestock behaviorists make a distinction between gregarious (defined by their clustering behavior) whiteface wool breeds, which display curious and contagious browsing behavior, and less gregarious blackface meat breeds, which are less likely to engage in curious cluster feeding and instead stick to grass.

Being aware of this basic (but certainly not definitive) distinction can be helpful in selecting a sheep breed for your particular silvopasture application. Of course, what your sheep choose to eat is also a function of what other forage is available. That means that if you put blackface sheep on poor silvopasture but have trees with accessible leaves, you're likely to find your trees browsed in short order. Similarly, if you put whiteface sheep on a lush pasture, don't expect them to browse trees or woody undergrowth.

However, it's important to realize that with sheep, as is true with humans, individual palates vary from one to the next. Selecting not just a breed but also individual animals that exhibit a willingness to forage broadly is important. Like cattle, sheep learn what to graze from their mothers, so don't dismiss the value of observing the foraging behavior of individual sheep in a flock when purchasing stock.

Frequent rotational grazing of sheep is also important, since boredom can lead to excessive browsing. If you notice a sheep that is browsing your crop trees instead of grazing grass, you should remove the animal from the flock before other sheep catch on to this destructive behavior. If possible, you should also avoid putting young lambs near your crop trees since they tend to investigate by browsing more than ewes do.

It's vital to provide adequate shelter — especially for shade in summer — as well as a watering station. If your sheep are in the silvopasture plantation only during the day and are returned to a barn or permanent pasture at night, you'll be able to get away with a simple pop-up tent and a portable watering system. If the silvopasture is used as a permanent home for your sheep, you'll want to build a sheep shed, preferably on the high point of the property. The use of woven wire fences, along with "electro-net" fencing for movable grazing paddocks, offers a second layer of protection. You may also want to consider using guard animals such as donkeys or Maremma guardian dogs.

SHEEP BREEDS FOR SILVOPASTURE SETTINGS

Breed	Foraging Ability	Homestead Use
Romney	Excellent woodland foragers; extremely hardy	Coarse wool, ideal for making warm and durable work sweaters
Scottish Blackface	Good foragers; will graze most grasses and sedges	High-quality meat produced even on relatively low-quality forage; horns are sought after by crafts-people for tool handles
Cotswold	Good woodland foragers that favor young vegetative sprouts	Pleasant, mild flavored meat; wool is excellent for hand spinning
Hampshire	Poor consumption of low-quality forage; picky eaters, thus a safe bet around crop trees	Large, fast-growing meat source; the milk is often sought after for cheesemaking
Suffolk	Poor consumption of low-quality forage; picky eaters, thus a safe bet around crop trees	High meat-to-bone ratio; fast growing and often used in 4-H and FFA competitions

ABOVE: *Scottish Blackface sheep are great grazers but will also browse, making them good candidates to help establish and maintain your silvopasture.*

FELLING YOUR FORAGE

If you're using goats, sheep, or cattle to help you clear land, consider a multiphase process that puts your livestock to work while reducing your feed costs. I practiced this over the course of nearly a year; by allowing the livestock to browse from freshly felled trees, I was able to reduce feed costs by about 10 percent.

Start by allowing your goats, sheep, or cattle into your proposed silvopasture to feed on undergrowth. Watch them as they feed to ensure that your crop trees aren't included in their browsing activities.

Once the livestock have grazed the understory to the point at which you're able to enter the silvopasture, begin systematically felling the trees marked for removal. Be particularly careful of cherry foliage/fruit since its cyanogenic acids are toxic to most livestock. Species such as birch, aspen, and maple can be browsed by most species without a problem. (If you're unsure of the suitability of your browse, contact your local Cooperative Extension office.) In winter, consider using "sweet" conifers such as white pine or Scots pine.

Browse loses nutrients as it dries out, so only fell as many trees as the animals can consume before wilting or defoliation. Make sure other feed and mineral rations are available so that your livestock are browsing by choice, not by necessity.

Most livestock will consume not only the foliage but also twigs and bark. The removal of bark allows the remaining wood to dry faster. What you're left with is a defoliated and partially delimbed tree that can now be converted to firewood without the hassle of dealing with leaves or small branches. At the same time, you've provided additional forage for your animal.

PIGS

While we've already explored the ways in which they can be used to develop a silvopasture, pigs can also be a key element in maintaining pasture systems.

Successfully raising pigs in silvopasture and pasture systems is a function of duration and intensity; in other words, allowing too many pigs to graze the same area for too long a period is likely to cause root and soil damage. For an established pasture where the goal is to mimic disking, or light tilling, you may want to consider a strip-grazing arrangement, in which a strand of electric fence is moved forward each day. By doing this, you allow the pigs to continually work the edge. If you move the water and pig housing along with the strips, you'll find that the pigs have little incentive to back-graze the land behind them, thereby allowing new seed to take hold.

While strip grazing is intended to mimic tilling or turning the soil, a less-intensive alternative practice is short-rotation grazing. The traditional practice of grazing pigs in oak forests is noted for producing uniquely flavorful pork. Perhaps the most famous acorn-raised pork product is Iberian ham from Spain. Iberian ham is made only from the black Iberian pig, which is raised in southern Spain near the Portuguese border in oak forests using a dehesa system (see **The European Dehesa System**). The pigs in this system consume up to 25 pounds of acorns per animal per day. The resulting hams are cured for up to three years and sell for over $100 per pound. In Appalachia, raising pigs on acorns is an old tradition that's enjoying new interest from gourmands who appreciate the savory and, not surprisingly, nutty taste. The most common breeds for acorn pork in North America are Berkshire, Large Black, and Red Wattle. If you want to experiment with raising pigs for acorn pork but don't have an oak silvopasture, consider finishing your pig on a diet of 60 percent acorns for the final three months.

Should your woodland homestead contain a small orchard, consider using a portable electric fence to rotationally graze your pigs as they approach finishing. This model tends to work well, since most pigs are harvested in late fall — the same time windfall apples litter the orchard floor. The apple-gleaning period should be kept rather short to minimize damage to roots of your crop trees.

ABOVE: *Allowing pigs to forage in nut groves and orchards is a great way to salvage a fallen crop, but be sure to practice rapid rotational grazing; pigs have been known to climb for fruit and nuts once the ground is bare.*

Regardless of the management system you choose, consider selecting heritage breed pigs, which are better suited for pasturing and grazing than industrial crossbreeds. Heritage breed pigs were bred for foraging ability and the hardiness to withstand temperature extremes. As factory farming took the place of homesteads and small farms in producing meat, industrial pigs better suited for confinement and commercial feed rations took the place of old breeds. Fortunately, many of these heritage breed pigs have started to make a comeback.

HERITAGE BREED PIGS FOR THE WOODLAND HOMESTEAD

Breed	Foraging/ Pasturing Abilities	Best Attributes
Large Black	Excellent	Extremely hardy; meat is sought for its rich flavor
Mulefoot	Excellent	Easy keeper; unique single (noncloven) hoof that resists rot, making it well suited to wet environments
Ossabaw Island	Excellent	Extremely hardy; thrives in hot/humid conditions
Tamworth	Excellent	Smart; good on pas- ture but rough on fences (Houdini-like)
Berkshire	Good	Hardy, with flavorful meat and good production in silvopasture arrangements
Gloucestershire Old Spot	Good	Traditionally used to clean up orchard waste and excess dairy whey
Yorkshire	Fair	Excellent mothers; lean carcass

THE EUROPEAN DEHESA SYSTEM

Among the oldest of silvopastoral systems is the dehesa system, which has been practiced extensively in both Spain and Portugal for centuries. The system is characterized by a two-layered, savannah-like vegetation structure where holm (evergreen oak) and cork oak occupy the overstory, and cattle, goats, sheep, pigs, and horses graze the understory. Leafy fodder, acorns, firewood, charcoal, and herbs are all harvested in the dehesa system. While the browsing animals are generally successful at keeping shrubs in check, periodic plowing is sometimes used as well. The plowing is also useful for nutrient cycling and soil aeration.

CATTLE

As the largest member of the woodland homestead, cattle can offer important contributions in the form of milk, beef, and pulling power (in the case of oxen). Whether to add cattle to your spread is a decision that should be made based on the size of your property. While site productivity varies greatly from region to region and site to site, you'll need at least 2 acres per cow/calf pair if you're hoping to rely on grazing and browsing for the majority of your animals' feed. Of course, if you live in a northern environment, you'll also have to consider winter feed, unless you simply raise a “feeder calf” over the summer to be butchered in fall.

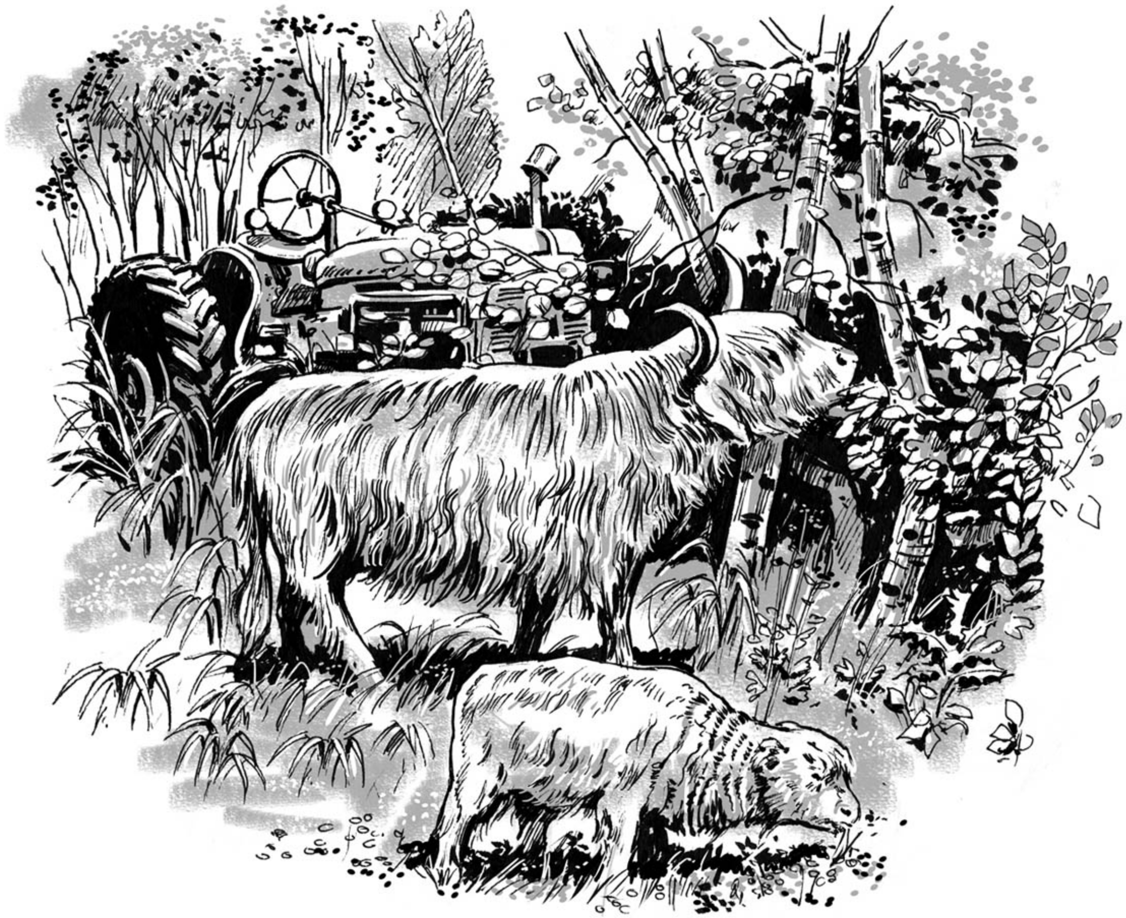
A family milk cow might fall under a different arrangement than beef cattle, if you choose to keep the family cow near the house or barn and bring harvested forage to her. You may also discover that based on the quality of the forage, she may need additional feed rations to meet her nutritional requirements, particularly while she’s lactating.

Many homesteaders like the idea of raising forage-fed beef but simply lack the land necessary for 1,500-pound animals. One option is to consider miniature cattle, which are more appropriately scaled for a smallholding. Miniature cattle are simply smaller individuals within the breed that have been intentionally selected out over time. Virtually all common (and some rare) breeds of cattle are available as miniature cattle, which are defined as between 36 and 48 inches tall at three years of age. Of course, natural variation occurs in all herds, so you may be able to ask local farmers if they’d be willing to part with any of their smaller animals. In many cases, production farms will be happy to move smaller animals out of the herd.

In terms of browsing behavior, beef breeds tend to be better browsers than traditional dairy breeds like Holsteins. Also, selecting a cow that shows strong browsing tendencies is important since she’ll teach her calves what’s edible. Finally, you’ll want to make sure that you select a breed that’s appropriate to your particular climate. Living in northern New York, I’ve found Scottish Highland cattle to be well suited to our subzero temperatures and browse-heavy forage.

CATTLE FOR THE WOODLAND HOMESTEAD

Breed	Uses	Foraging/ Pasturing Abilities	Best Attributes
Belted Galloway	Primarily beef	Excellent	Wonderful marbled beef; commonly crossbred with Scottish Highlands
Scottish Highland	Primarily beef	Excellent	Docile; hardy; easy keepers
Hereford	Beef	Good/excellent	Good disposition; efficient growth; ideal for crossbreeding
North Devon (Red Ruby)	Beef/dairy/oxen	Good/excellent	Docile; hardy; high fertility rate
Dexter	Beef/dairy/oxen	Good	Small size and good disposition; popular on homesteads
Texas Longhorn	Beef	Good	Hardy; high-quality beef
Jersey	Dairy	Fair/good	Richest milk of all dairy cows; does well on pasture



ABOVE: *Selecting both a breed and individuals that are well suited to the browse found on your property is an important part of matching livestock and land. When purchasing animals, observe and select those individuals that show an opportunistic palate, good demeanor, and solid build.*

Mob-Grazing Poultry

Portable electric fences have made mob-grazing poultry all the rage. Because it's easier than ever to confine and move chickens, the fertilizing benefits of chickens are also easy to capture. The key to successful mobgrazing is to have fresh pasture each day. One common arrangement is to follow cattle in a mob-grazing arrangement in which chickens are able to feed on beetles and insects that are attracted to the "cow patties."

While placing a large number of animals in a relatively small area wouldn't be advisable under most circumstances, the fact that chickens are turned onto a new buffet daily (or twice a day in some cases) creates a healthy and systematic grazing system. This arrangement of intensive, short-term grazing is in many ways analogous to the way many animal species move — whether it's a flock of sheep or a herd of cattle.

By mimicking these natural, intensive grazing behaviors, you can greatly improve soil fertility, not just through the addition of manure but also through the mulching of grass/forbs. This matted mulch can help create an ideal microclimate (warm and moist) for promoting healthy, biologically rich soil. What's more, by using an intensive mob-grazing system, you're ensuring an even application of fertilizer — a near impossible goal using free-range methods.

HOMESTEADER PROFILE

Atlas Hoofed It Farm

Dan and Sara Burke

Dan and Sara Burke are the owners and operators of Atlas Hoofed It Farm, in Sugarbush, New York. As small farms go, the Burkes' farm is about as unconventional as it gets. Their 80-acre spread is a former missile silo site that was decommissioned during the 1960s. Dan and Sarah decided that turning a site devoted to destruction into one that produces healthy, local food was a transition of the highest order. Standing between them and the missile silo was a low-quality forest, replete with invasive species.

Using a combination of Scottish Highland cattle for browsing and an army of nearly five dozen pigs, the Burkes have been able to reclaim this denuded site, reducing invasive species by using intensive grazing. One of the primary challenges of reclaiming the land was that much of the topsoil was scraped off prior to its development as a military installation. To amend the soil naturally, the Burkes practice multispecies grazing, where pigs periodically turn the soil, mixing organic and mineral material. The pigs also play an important role in controlling unwanted plant species such as sheep sorrel and goldenrod.

Believing that efficiency is the absence of waste, the Burkes have established a pre-consumer food scrap network whereby Dan does a daily run to local supermarkets, restaurants, co-ops, and colleges to collect pre-consumer kitchen scraps and day-old breads for their pigs. In a week, Dan is able to collect nearly a ton of scraps, thereby saving perfectly good food from going to the landfill and reducing the farm's feed costs 50 percent. The businesses also appreciate this arrangement, since it saves them the cost of disposal.

MULTISPECIES GRAZING

So far, we've explored the use of various livestock species as individual components in multistep systems (e.g., clearing land with goats or sheep to create pasture). However, integrated multispecies grazing is a strategy that is particularly well suited to small-scale livestock operations on the woodland homestead.

So just what is multispecies grazing? Simply put, it is the use of more than one species of herbivore to graze your pasture. Having an understanding of the agroecological niche and forage requirements of various species, you can integrate a variety of livestock, including chickens, goats, sheep, horses, and cattle.

There are many benefits of multispecies grazing. First, if you're converting an abandoned woodlot or forgotten forest to a silvopasture/pasture system, you're likely to have high plant diversity that's not entirely suitable to a single species. By integrating multiple species, you're able to better use what your land is producing. Because multispecies grazing means that no single plant species is targeted, it is easier to maintain a diverse, high-quality pasture. In the conversion or reclamation of pastures, it is useful to think about your available forage as browse, forbs, or grass. Browse includes trees, shrubs, and vines; forbs are essentially broad-leafed flowering plants that most of us would consider weeds. For example, thistle (*Cirsium* spp.) or spotted knapweed (*Centaurea stobe*) grasses are flowering monocots, which account for most livestock forage.

The successful integration of livestock species is dependent on understanding how grazing preferences differ among species and various breeds. Consult the breed charts throughout this chapter to select the breeds most appropriate for your application.

While we normally think of larger livestock for grazing applications, smaller livestock such as rabbits and chickens can also be an important part of multispecies grazing, especially in terms of balancing the nutrients that are returned to the soil. Nitrogen deficiencies, for example, can be corrected by incorporating chickens in your grazing plan, but it must be done properly. Chicken manure on a pasture with low grass and forbs isn't ideal, since the unincorporated manure is likely to burn off as ammonia. Instead, one option is to allow poultry to graze taller grasses and forbs, which will fold over, creating an ideal (moist) environment for nutrient movement and uptake. This same approach can be used with rabbits; however, you’ll want to reduce the amount of time they’re allowed to graze in one area, since rabbit manure has higher concentrations of nitrogen, phosphorus, and potassium than chicken manure does. If your pasture is too short to practice the folded-grass method, consider following up your grazing sequence with cows or horses, either of which will mix the manure in the soil through hoof action.

PARASITE CONTROL

Another benefit of multispecies grazing is parasite control. In a single-species grazing system, worm eggs are deposited on the pasture through manure; the eggs then hatch, attach to new growth, and are consumed by grazers. This repetitive cycle results in an accumulation of parasites, thereby threatening the health of your herd. Multispecies grazing offers a disruption of this cycle that can keep parasite levels in check. Since most parasites are species-specific, a mutualistic relationship is established whereby cattle ingest sheep-worm larvae and vice versa. The consumption of parasites by nonaffected species keeps parasite levels in check. It is worth noting that the larvae are generally close to ground level; maintaining higher forage levels can therefore be an important parasite control mechanism. This is especially true for goats, which can develop serious parasite levels if they’re forced to graze close to the ground.

Finally, it's worth mentioning that multispecies grazing can help make your land more productive while at the same time reducing costs. The addition of goats to cattle systems, for example, means that aggressive shrub species such as multiflora rose, honeysuckle, and blackberry brambles can all be controlled by goats, allowing light to get to the pasture floor and thereby establishing additional forage for cattle. In fact, there are many studies that suggest you can add one goat per cow to a pasture without any reduction in cattle performance. What's more, you'll be controlling weed species without the use of herbicides or labor-intensive mechanical pulling, while adding a new productive member to your woodland homestead.

CHAPTER 4

The Coppice Forest

Fauna, Fodder, Fuel, and Furniture

Of all the forestry techniques available to woodlot owners, perhaps no other method is more underused than coppicing. Coppicing is a reproduction method whereby a tree is cut back periodically to stimulate new growth through dormant buds on the “stool,” or stump. In turn, these buds develop into shoots capable of growing firewood and a host of other products in just a few years, instead of decades.

WOODLOT LINGO

Bogget. A craftsperson who uses green wood, primarily from coppice harvests, to produce rustic goods.

BTU. British thermal unit. A unit of energy equal to 1,055 joules. Commonly used to express the stored energy of firewood.

Coppicing. A method of reproducing trees through dormant harvesting that encourages continual growth of multiple stems for a variety of wood products.

Face cord. A stack of firewood measuring 8 feet long, 4 feet high, and 16 inches deep. In other words, one-third of a full cord.

Faggot. A bundle of sticks lashed together and traditionally used to produce a small, hot cooking fire. Modern uses include erosion control and streambank stabilization, where the faggot bundles act as a barrier to keep soil in its place.

Full cord. A stack of firewood measuring 8 feet long, 4 feet high, and 4 feet deep.

Layering . A method of vegetative reproduction in which branches root once in contact with the ground.

Maiden. A tree that has never been coppiced.

Mast. Fruit or nuts produced by trees.

Pleachers. Partially severed saplings grown at an angle to form hedges.

Pollarding. Aggressive pruning of a tree's upper branches to encourage dense head growth. Historically used for producing animal fodder and living fences.

Rhizosphere. The narrow region of soil that is directly influenced by root secretions and soil microorganisms, including fungi.

Shredding. (Also called "snedding.") Removing the lateral branches from a main stem for kindling or animal forage.

Standard. A single-stemmed crop tree, usually reserved for mast or lumber.

Stool. A living stump from which new coppice stems will grow.

Sucker. A vegetative sprout originating from rootstock.

Teller. An acceptable growing stock in the sapling or pole stage capable of becoming a desirable standard.

Underwood. Coppice trees in the understory.

A BRIEF HISTORY OF COPPICE FORESTRY

Coppicing as a forest management technique dates back to the Neolithic period, when coppice wood was used for a variety of purposes, ranging from bean poles and lath to firewood and fenceposts. In fact, the economic importance of coppice firewood was so significant that Henry VIII required fences to be built to protect coppice forests throughout England. However, over the last century, Britain has lost more than 90 percent of its coppiced woodlots because of land conversion, abandonment, and modern forestry techniques that favor longer rotations and a focus on industrial lumber production instead of utilitarian products for use around a smallholding.

In North America, coppicing has been a rather limited practice, not because of ecological limitations but simply because the vastness of early North American forests didn't necessitate efficiency in *growing* trees, only in *harvesting* trees. This stands in contrast to Britain, where prehistoric settlement, larger populations, and a smaller land base forced rural communities to develop more efficient land-use methods, including coppice forests.

In recent years, there has been renewed interest in coppice forestry throughout Western Europe. The British Forestry Commission is currently promoting the restoration and rejuvenation of forgotten coppice forests. In fact, this renewed interest in coppice systems has led to the development of a new research area known as short rotation forestry (SRF) and generally refers to wood that is between 8 and 20 years old. The renaissance has come about in part because of demand for the wide variety of products that coppice forestry produces and in part because of the role that coppice forestry plays in the rural economy related to nontimber products such as baskets, bean poles, fuel wood, and charcoal.

While the historical dependence on coppice systems is limited in North America, their potential for application is great, particularly at the homestead level. Central to making this transition will be a change in the way we view forests: not as simply vertical lumber yards or, conversely, as preserves where resources are left unmanaged. Somewhere between these competing paradigms is a more utilitarian view that sees coppice forests as a way to fill your woodshed, toolshed, and larder.

BENEFITS OF COPPICING FIREWOOD

Certainly, the most obvious advantage of coppicing is rapid growth, thanks to the already established rootstock. This regenerative advantage eliminates the need for a tree to allocate significant resources to germination and root development and instead focuses the tree’s energy on developing rapid vertical growth in the form of shoots. In many cases, this means that you can harvest a tree in half as much time as an equivalent tree grown from seed.

Because coppice forests depend on healthy root systems, sound management of these forests also prevents erosion in the surrounding landscape, thanks largely to the stability afforded through a healthy rhizosphere capable of developing into a well-anchored mat of latticed roots.

As a forester, I'm often asked how long it will take for a tree to grow to a specific size. If I know something about the site, I can make an educated guess. However, more often than not, there are too many factors at play to make any sort of reasonable estimate, since both environmental and genetic factors influence growth rates. Environmental factors include climatic conditions as well as soil quality. Primary genetic attributes include vigor, disease resistance, photosynthetic efficiency, and, of course, species. Almost without exception, some species will grow faster than others, even in a less suitable environment. Willows, for example, will almost always outpace oaks in terms of growth rate, while beech trees in a northern hardwood forest are notorious for outcompeting maples and birches, creating thick single-species stands.

Because of this natural variation, it is important to avoid broad generalizations regarding yield. However, despite the many variables, coppice systems offer two clear benefits over trees grown from seed. The first benefit is reduced establishment time, meaning that you need not wait for a seed to germinate, establish, and develop a full root system. The second benefit is that since coppice trees form multiple stems, instead of a single stem, you have the opportunity to grow significantly more wood.

HOW IT ALL STACKS UP

The following example illustrates how coppice firewood production stacks up against trees of seed origin. All of the trees in this case study came from the same site, so as to minimize variability.

First, I cut down a 40-year-old American beech tree with a single stem, likely established from seed. The tree measured 8 inches diameter at breast height (DBH) and yielded one face cord. As a point of comparison, I then harvested coppice-grown trees (with three to four stems each) to see what it would take to equal the same wood volume. The harvest included two 15-year-old coppiced gray birch and one 18-year-old coppiced American beech — all of which produced one face cord. In other words, *equal wood production in less than half the time*.

While this isn't a perfect comparison (gray birch has fewer BTUs than beech, and this 40-year-old teenager of a beech was just entering its most productive growing years), the example stands as a testament to the production benefits associated with coppicing.

ESTABLISHING A COPPICE WOODLOT

Depending on the conditions of your woodlot, you'll be either establishing new coppice stools from maidens or tending a long-forgotten coppice stand that may or may not have been created intentionally. Either way, the methods outlined in this section will serve as your blueprint for improving the health and productivity of your coppice woodlot.

START WITH ESTABLISHED TREES

To begin, it's important to choose trees that are well established (4-inch base diameter minimum), since the diameter of the stool being coppiced is proportional to the number of shoots that can be produced. In other words, larger stumps have the potential to produce more wood. At this point, being able to refer to your woodlot inventory will be important (see **chapter 1**). The information you collected about the species, size, and health of the trees will help you make informed management decisions.

The shoots that eventually develop in a coppice system usually originate as *dormant buds* located under the bark at the base or side of the stump. Shoots can also be *adventitious buds* that sprout from callus tissue that forms between the bark and the cambium (the layer of active cell growth just under the bark) at the cut surface. Generally, dormant buds forming at the base or side of the stump are healthier and more vigorous

COPPICING IN FOUR STEPS

While coppicing can be done any time of the year, your best results are achieved when the trees are dormant: between late fall and early spring, prior to leaf-out. Select trees with poor form that have little value as saw logs or other forest products. Quality, defect-free single stems should be considered for use as standards (see **here**).

Cut Low, Angled Stumps

A low stump encourages the establishment of new shoots at or below ground level; this promotes the development of roots and increases the tree's stability. The ideal new coppice stool should only be 2 to 3 inches above the ground and should slope slightly to shed water. If possible, cut the stumps at a south-facing angle, to minimize the potential for rot. It is also worth noting that some studies have shown that higher stumps produce more shoots initially, but the trade-offs of decreased vigor over time and lack of stability suggest that lower stumps are still more preferable.

If you're harvesting a previously coppiced stump, make the same angled cut just above the point at which the stool splits into multiple stems. It is important that the cuts be clean, with no separation of bark from wood. In order to achieve this clean cut, make sure your saw is sharp and fell the tree at knee height, then trim the base at the appropriate angle. This method not only ensures a clean cut but also leaves you with a firewood-length trim piece.

Deter Browsers

If you live in an area that is prone to animal browse, I recommend placing branches around the stool as a deterrent. Another approach is to develop a coppice system using species that are less palatable to browsers. Beech and birch, for example, are less likely to be browsed than maple and oak.

The size of your woodlot will determine the appropriate method for deterring browsers. On smaller sites, fencing the entire area to protect new growth may make sense. At a larger scale, fencing may be cost prohibitive. In that case, you may want to consider harvesting larger areas as a means of deterring wildlife (because most wild animals prefer to forage in small gaps in the forest or along the edges of a large open area).

A British Forestry Commission study determined that harvests larger than 1 hectare (2.47 acres) were more effective at deterring wildlife browsing than smaller group-selection arrangements (essentially miniature clear-cuts). If browsing threatens the establishment and growth of your coppice woodlot, consider hunting or trapping as a means of controlling the damage (and filling the soup pot at the same time).

Remove Small Sprouts

In early spring you'll begin to see numerous sprouts emerge from the stump, forming a J-shaped leader. After leaf fall, clip off the smaller, less vigorous sprouts. On average, leave four to six sprouts per stool.

BEST TREES FOR COPPICING

Since not all tree species are well adapted to coppice reproduction, it's important to select species that have a proven record of efficiency and productivity. The following chart outlines those species that are most suitable for coppice production, along with their potential uses. Often, trees of various species that are within the same genus can possess similar wood qualities and uses. These interchangeable species are identified by the abbreviation "spp."

Common Name	Scientific Name	Homestead Use
American beech	*Fagus grandifolia*	Nuts, tool handles, coppice firewood, butcher blocks
American chestnut	*Castanea dentata*	Nuts, fence rails, shingles, lumber
American elm	*Ulmus americana*	Hoop house poles, barrel staves, wagon hubs, punishment for teenagers (make them split a cord by hand)
American hophornbeam	*Ostrya virginiana*	Windbreaks, riparian buffers, posts, tool handles, mallets, BTU-rich firewood
Apple	*Malus* spp.	Fruit, animal fodder, firewood, smoking meat and fish
Aspen	*Populus* spp.	Lightweight lumber, kitchen utensils; sawdust and shavings are used for animal bedding and wall insulation
Black ash	*Fraxinus nigra*	Basket splints, snowshoe frames, firewood
Black birch	*Betula lenta*	The sap can be boiled to make syrup; this species is also used to make birch beer; the tree makes high-BTU, fast-growing coppice firewood as well
Black cherry	*Prunus serotina*	The fruit can be used in jams and pies, also as a natural flavoring agent in homemade soda; the wood is valuable lumber that can also be used for smoking fish and meats; the galls formed by black-knot disease make attractive and functional bowls
Black locust	*Robinia pseudoacacia*	Fenceposts that rival steel in strength and rigidity; also used for living fencing and has a BTU factor that rivals coal; nitrogen-fixing ability makes it ideal for

		agroforestry applications
Osage orange	*Maclura pomifera*	Bow making, shelterbelts, living fences, orange dye, outstanding firewood
Paper birch	*Betula papyrifera*	The bark is useful for making baskets and starting fires; the wood coppices easily and makes good firewood
Red alder	*Alnus rubra*	Used to improve soil quality through nitrogen fixation; the bark can be used to make a red dye; the oily wood is ideal for smoking fish
Red maple	*Acer rubrum*	Maple products (though the sugar content is lower than sugar maple); the tree is also a prolific coppice sprouter, making it ideal for firewood coppicing
Red oak	*Quercus rubra*	Tanning leather, making fenceposts and furniture, producing firewood
Rowan	*Sorbus aucuparia*	Livestock fodder, erosion control, tool handles
Sugar maple	*Acer saccharum*	Maple syrup, maple sugar, livestock shade, excellent firewood
Willow	*Salix* spp.	Basket making, animal fodder, bentwood furniture, wattle fences, brooms

Harvest

The amount of time it takes to produce your first firewood crop will vary depending on species, site, stool size, and desired firewood diameter. I've established my coppice forest in such a way that I'll be able to harvest in 8- to 12-year cycles. For my more productive trees, this will yield firewood that's 3 to 4 inches in diameter — small enough to avoid splitting. The beauty of coppice production is that if you maintain trees in a juvenile stage, they will never die of old age.

SLOW GROWTH = HIGHER BTUS

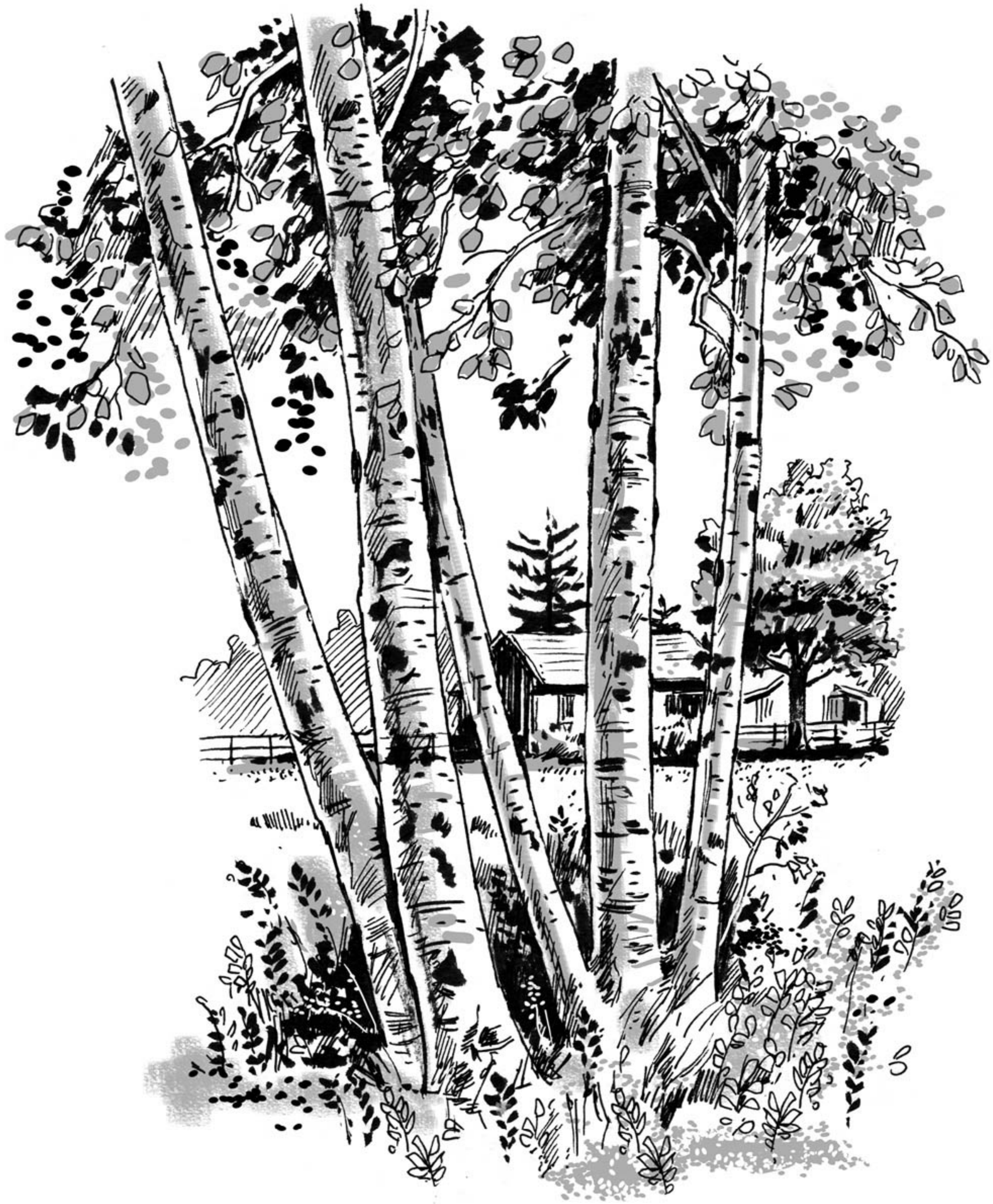
If you're establishing a coppice woodlot primarily for firewood production, realize that in many cases there's an inverse relationship between rate of growth and the energy potential of coppice species. If we were to rank four common species in terms of estimated growth rates, and compare those growth rates to their energy potential, we'd see that as a general rule, slower-growing trees have more BTUs. It is important to be aware of this time/energy trade-off whether you're trying to decide which species to coppice or purchasing firewood and faced with the question of which species will yield the most heat per dollar.

Species	Estimated Growth (to produce 4 to 5 tons/acre)	Million BTUs/Cord
Poplar	3–6 years	13.7
Red alder	6–8 years	14.8
Paper birch	16–20 years	20.0
American beech	40–60 years	22.7

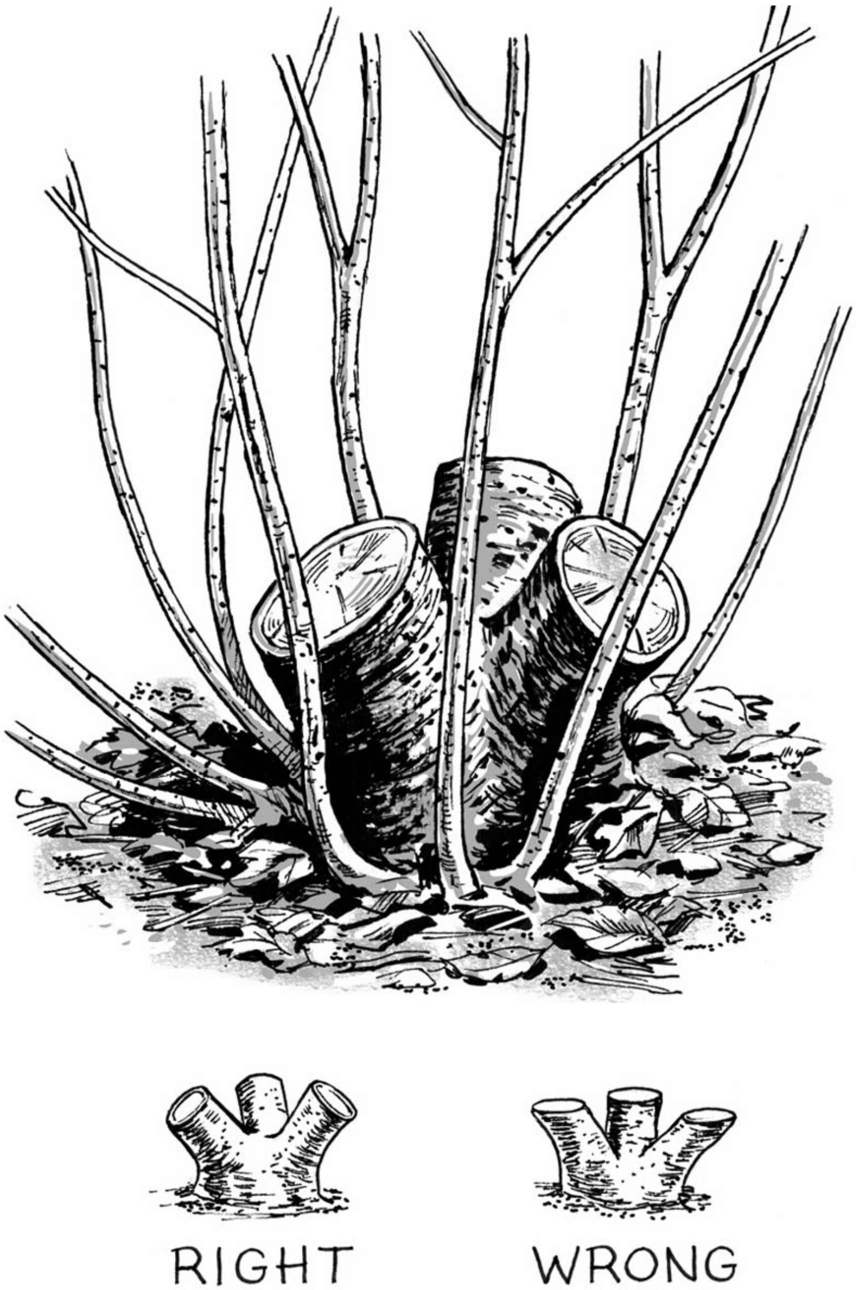
CONSIDERATIONS WHEN COPPICING

The long history of coppicing in European forests has provided a surplus of data regarding species' ability to coppice over the long term and optimal coppicing diameters unique to European species and growing conditions. Because coppicing has been so limited in North America, relatively few studies have focused on coppicing species native to the continent. One exception would be a seminal 1967 U.S. Forest Service study, which revealed important differences between sugar maple and red maple in terms of sprouting capacity and size. In sugar maple, for example, sprouting capacity was found to be greatest in smaller trees and became limited by the time a tree reaches the 12- to 14-inch DBH class. In red maple, sprouting was found to increase up to the 10-inch DBH class but remained a steady sprouter through the 20-inch-diameter class. This sort of species-level data can be extremely useful in guiding your coppice strategy.

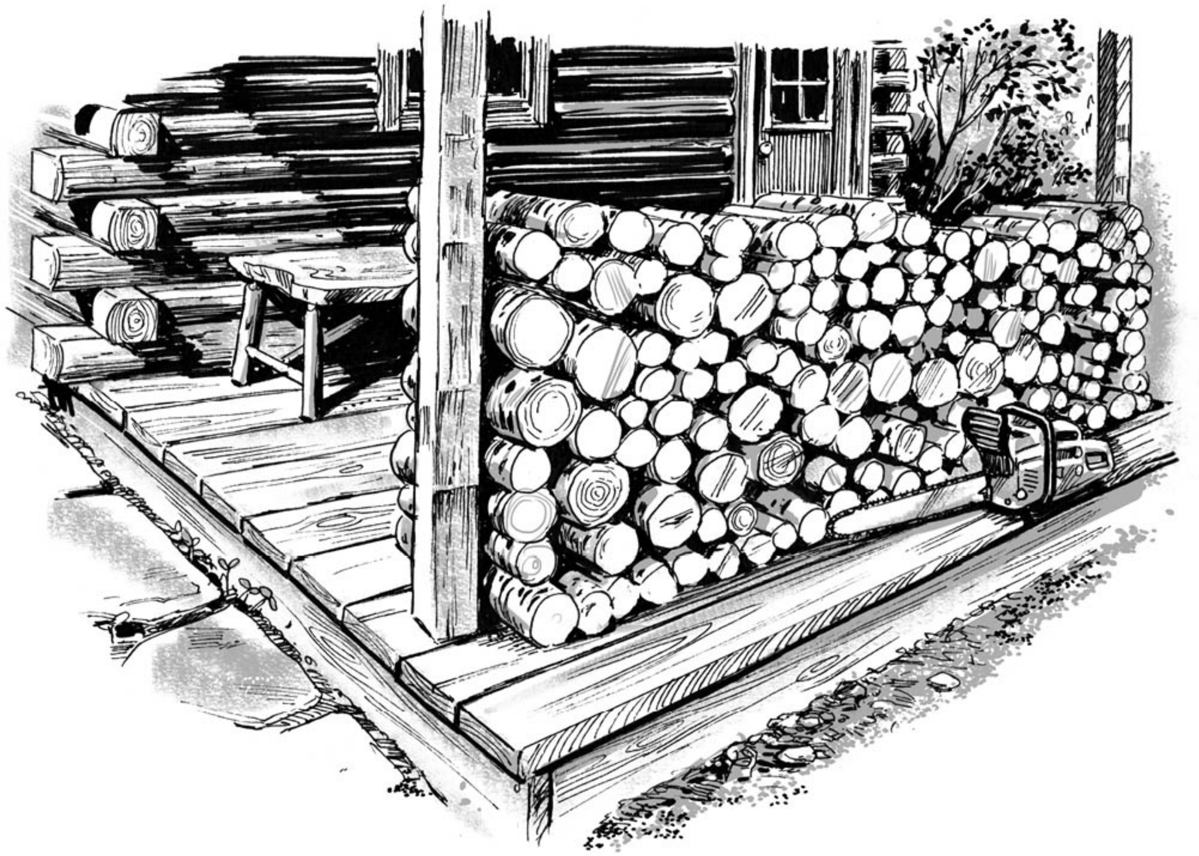
In the event that species-level coppice data doesn't exist for the trees in your woodlot, there are several considerations that hold true for most species. First, avoid very young trees and old growth. Sapling-stage trees may lack the necessary root structure and carbohydrate storage capacity to successfully coppice. You should also avoid mature trees, particularly those with thick bark at the base. One of the primary functions of bark is to protect the tree's cambium; however, as the bark thickens, it becomes more difficult for the dormant buds to stump-sprout.



ABOVE: *This group of birches is actually two trees. In this case, I opted to coppice the three-stemmed clump on the right.*



ABOVE: *Here is the birch stool 10 weeks after coppicing. You'll want to retain the most vigorous sprouts, removing less vigorous sprouts as soon as the tree goes dormant.*



ABOVE: *Two 15-year-old coppiced gray birches and one 18-year-old coppiced American beech add up to a face cord on my porch.*

OTHER WAYS TREES REPRODUCE FOR COPPICING

So far, we've primarily discussed stump coppicing as a means of producing vegetative sprouts. However, it is important to note that two other vegetative reproduction strategies exist: layering and root suckering.

Layering is a relatively common reproduction method, particularly in spruce forests. When a lower branch or bough comes in contact with the forest floor, the tree is able to set roots off the dormant branch bud and is thereby capable of independent growth after separating from the parent tree. Because the limbs of spruce trees grow in whorls, this can lead to the forest developing in a concentric pattern from one successive generation to the next. The trees that develop through layering are typically single stemmed and are genetic clones of the parent tree. One common homestead application of layering is the construction of hedges, or living fences, as described in **chapter 5**.

Root suckering is a process whereby dormant buds of shallow roots send up a single leader, which, as in the other asexual reproduction methods, is a clone of the parent tree. Relatively few species root sucker, though two notables are American beech and aspen species. One distinct advantage of root suckering over traditional stump sprouting is the relatively even spacing that results, since the sprouts follow the root mat instead of originating from a single coppice stool.

Essentially the same management practices can be used to encourage both root suckering and stump sprouting. Suckering is encouraged by cutting the parent tree during dormancy. The tree’s survival response is to use the stored energy in the roots to grow root suckers and stump sprouts at the same time. For species that do actively sucker, prescribed fires can encourage suckering vigor. However, harvesting parent trees during dormancy still appears to be the best method of encouraging root suckering. In one study, an aspen stand cut in winter produced four times as many root suckers as one cut during summer. In light of this, you should plan your harvest schedule carefully.

CREATIVE WOODLOT TENDING

Every woodlot needs tending, especially those that have been neglected for quite some time. The time you spend in the woods maintaining your coppiced trees can be combined with other tending operations that will allow you to rejuvenate your woodlot and achieve a broader range of goals, like timber production or wildlife habitat improvement. Among the most important aspects of managing your woodlot are tending activities that focus on improving the quality of the trees and your woodlot by ensuring that your acceptable growing stock (AGS) has the light and growing space it needs.

Think of tending as the maintenance program for your forest, which can be timed to coincide with other activities like cutting firewood, thinning coppice sprouts, or harvesting fruit in your woodland orchard. These tending operations include release treatments, thinning, and pruning.

RELEASE TREATMENTS

The goal of a release treatment is to free relatively young trees (seedlings and saplings) from competing vegetation. The treatments include weeding out competing seedlings (usually by mowing); taking down competing trees of the same size (selecting healthy, well-formed, well-spaced trees to leave behind); and removing larger, overtopping trees to allow more light for the saplings below.

Thinning

Thinning is similar to a release treatment; however, it's targeted at trees past the sapling stage. The goal of thinning is to give each crop tree the room it needs to grow, with the goal of improving the overall quality of the stand. Two thinning methods commonly employed in woodlot management are low thinning and free thinning.

Low thinning aims to mimic natural thinning processes that result in larger trees shading out smaller ones, leading to the establishment of distinct crown classes, which create a multilayered forest. To do this, remove suppressed and intermediate trees that likely wouldn't be able to compete with more vigorous surrounding trees. In essence, low thinning aims to speed up natural forest succession by removing trees that are unlikely to survive but are still occupying valuable growing space.

Free thinning focuses on the development of evenly spaced, selected trees known as alpha stems, which are usually retained until maturity as crop trees. Any other trees that threaten the alpha stems are removed to eliminate competition. Unlike low thinning, which is focused on removing competition in the lower canopy, free thinning promotes the removal of both lower canopy trees and larger crown trees to create ample growing space around individual crop trees.

REASONS TO THIN YOUR WOODLOT

- Allow your acceptable growing stock (AGS) to not only survive but thrive.
- Increase your yield, in terms of quantity and quality of woodlot products.
- Use thinned material for a variety of homestead projects.
- Shorten the rotation time between harvests.
- Maintain forest health.
- Improve aesthetics.
- Allow intermediate harvests of small and large trees before the final harvest.
- Control species composition by removing undesirable species.
- Get a leg up on next year's firewood supply.
- Increase accessibility and recreational opportunities.

Pruning for Clear Wood

The creation of clear, knot-free wood is the most common reason for pruning. Unpruned branches create knots, which not only compromise the strength of the wood but also create uneven grain that can be difficult to work. Once a branch is pruned and the wound has healed, the tree will begin growing new layers of wood that are clear and free of knot disturbance. As a general rule, the sooner you prune a branch, the better. Smaller branches create smaller wounds, which serve as less of an entry point for insects and diseases.

Some species, such as most pines, are self-pruning. This simply means that the lower branches die in the shade created by the crown above. After several years, these branches shed naturally. However, if they can be pruned while they're still alive, the tree will heal faster and will have a smaller knot.

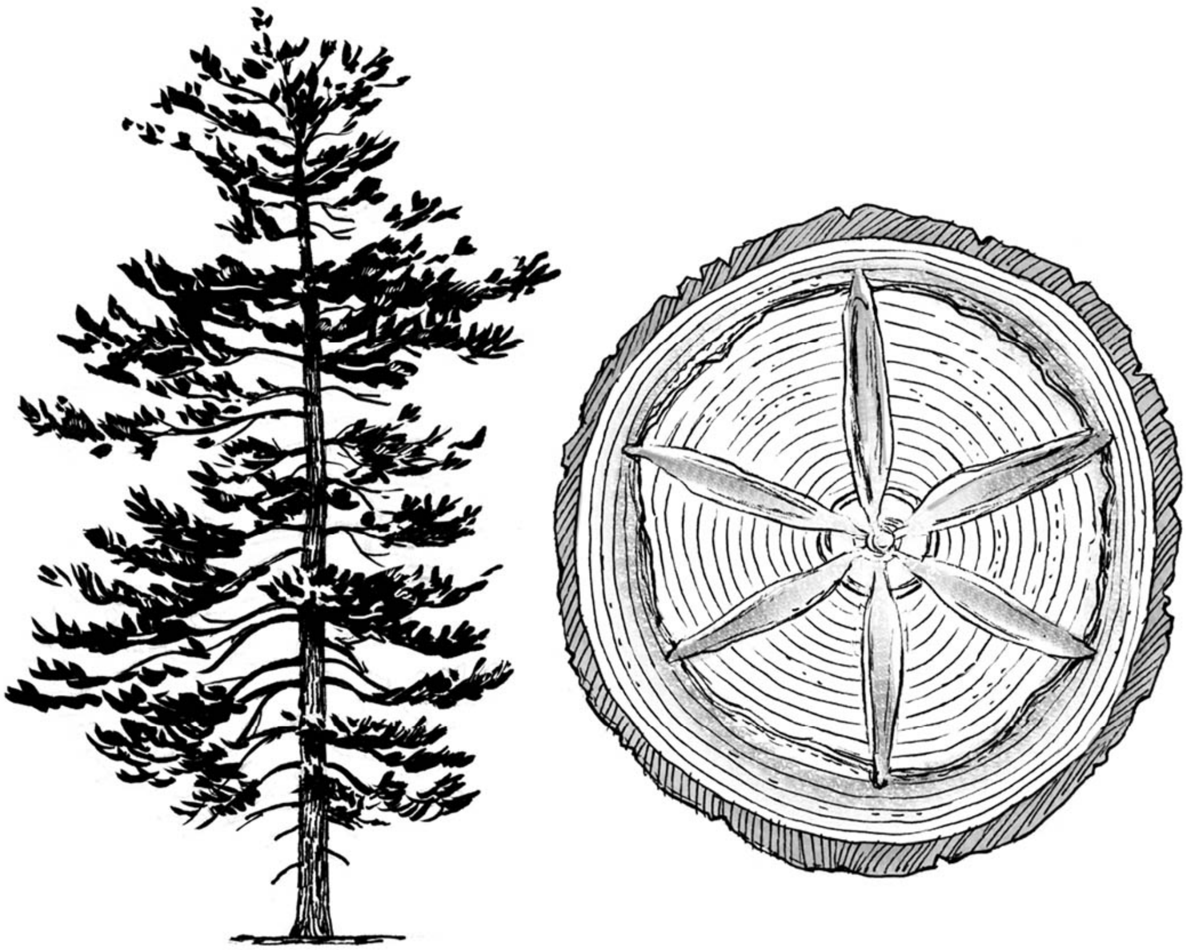
The defect that results from a dead branch becoming encased in living wood is known as a black knot and generally represents a fairly serious structural flaw should that wood be used as lumber. This is because the live wood growing around the dead branch (stem wood) can't bind as well as cells of a living branch that's encased with living wood. As wood dries, the moisture differential between the dead knot and the surrounding wood often results in the black knot loosening and eventually falling out. This obviously compromises the strength of the wood.

"Red knots," which are named for being red-tinged in conifer species, represent live branches that have become encased in stem wood. This interface of live cells between the branch and stem wood bond so strongly that these knots rarely fall out of lumber and, structurally, are only second to clear, knot-free wood.

Other Reasons to Prune

While you may not always have the chance to remove live branches, you should still prune your crop trees regularly. Research has shown that pruning can in some cases reduce the prevalence of disease in forests by increasing air circulation and providing fewer hosts (in the form of dead branches) for forest pests. In the western United States, pruning can be an important technique for managing wildfires, simply by removing dead branches that act as ladder fuels.

Finally, if you're fortunate enough to have fruit trees on your homestead, pruning is an import aspect of encouraging bountiful fruit production. Specific pruning techniques are examined in **chapter 6**, and pruning tools are discussed in **chapter 2**.



ABOVE: *The star pattern on this log represents a branch whorl that was pruned, allowing clear, knot-free wood to grow on the outer rings.*

COPPICE WITH STANDARDS

To promote greater biodiversity than what exists in traditional, even-aged coppice systems and to produce a wider range of goods for the homestead, consider coppicing with standards —

trees with a single, upright clear stem. This is a hybrid system that combines the production of young coppice trees alongside standards that are grown from seed and allowed to mature into mast producers and eventually timber.

BENEFITS OF COPPICING WITH STANDARDS

The primary benefit of coppicing with standards is that the woodlot is able to produce goods both annually and over longer periods of time. Historically, American forestry practices have focused on creating quality timber, a goal that in many cases isn't realized within a human life span. The discipline and commitment to the future this requires are certainly admirable qualities, especially given our penchant for instant gratification in modern society. However, a forest or woodlot need not simply be a gift to the future. It's hard to imagine a scenario as rewarding as harvesting firewood, fruit, nuts, and craft materials annually in a woodlot among standards that may one day become the wood for your grandchild's home. It is this vision that has led to exploration of alternative hybrid methods.

Intentional development of coppice with standards dates back at least 1,000 years in the British Isles. In most cases, the standards were planted from the mast of well-formed dominant trees. Oaks and beeches were most commonly planted as standards and were usually grown in a semigeometric pattern to ensure efficient use of space and access to sunlight. Because of the importance of efficiently managed woodlots to the self-sufficiency of Britain, the government historically enforced a rule that required 8 to 20 standards per acre.

In this kind of system, standards occupy the forest overstory, and the understory is managed for coppice products. These two distinct crops can coexist easily, as long as the understory continues to receive adequate sunlight. Maintaining sufficient levels of light on the forest floor is achieved through both the pruning of standards and their occasional removal. At the homestead scale, you have the benefit of being able to remove and use a single standard; at a commercial scale, the inefficiency associated with removing a single tree is usually cost prohibitive.

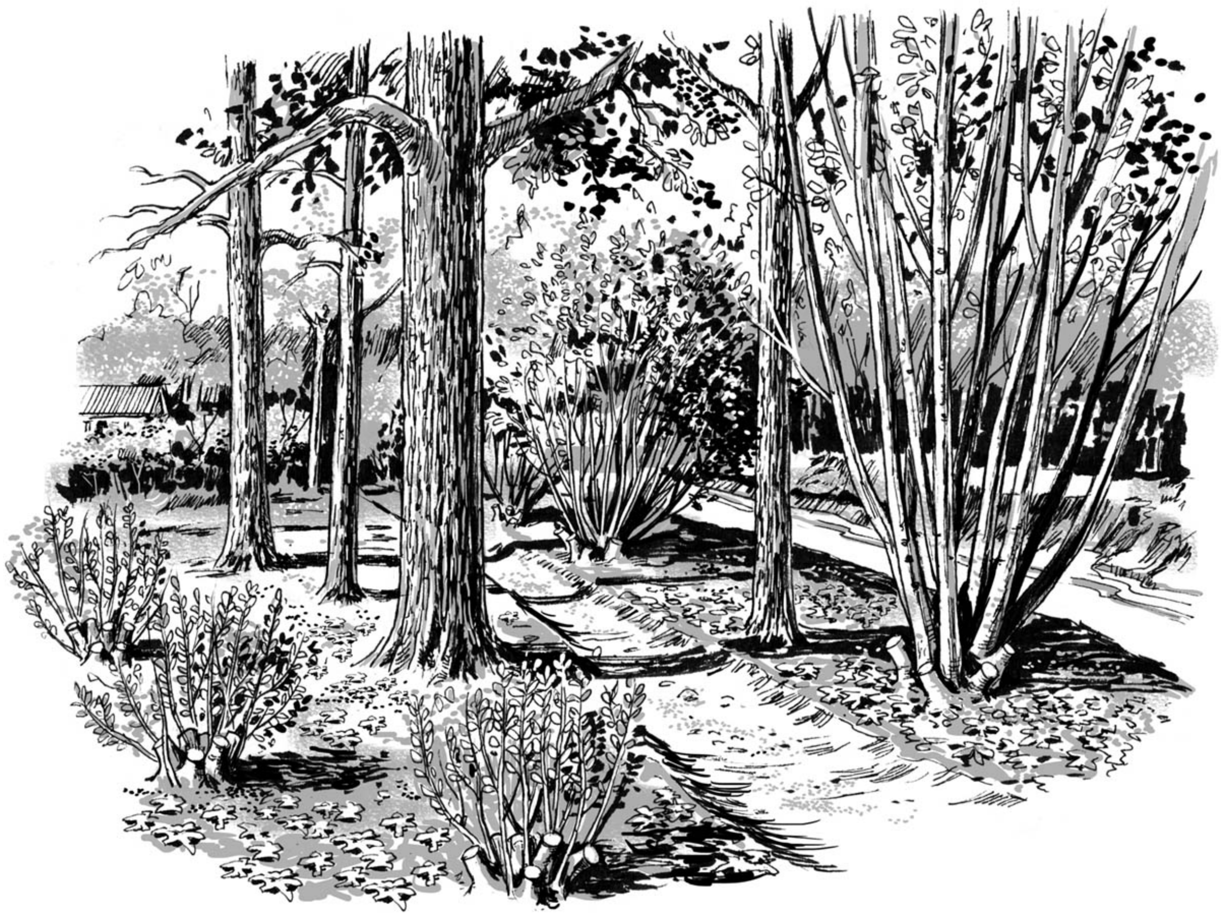
A LABOR OF LOVE

To be clear, methods like coppicing with standards and the other intensive approaches to woodlot management described in this book should be conducted not simply for the goods they supply but also as a labor of love. Removing a single standard or handling smaller coppiced firewood represents a commitment to working the land, which is rewarded in products but also through the development of your woodland eye and a newfound appreciation for your homestead woodlot.

In time, your vision will sharpen and you'll notice details that were once lost among the brambles. You won't be able to help yourself from noticing which trees leaf out first or where in the woodlot the deer bed at night, or maybe you'll finally *see* one of those spring peepers that up to this point you had only *heard*. You may also find that your homestead woodlot becomes the larder where you run to pick mushrooms or hang buckets each spring to gather sap for boiling into syrup. In your relationship with your woodlot, you're the steward. And like all other meaningful relationships, this one takes time to develop.

CONSIDER WHAT'S THERE

Before you begin clearing your existing woodlot just so you have space to plant standards, consider what's already there; you may be surprised to learn that potential standards already exist. As you review your woodlot inventory, note the large-diameter trees categorized as AGS. Potentially, these trees may represent standards if they are large and of good form, or future standards known as tellers if they have the potential to become standards over time. Importantly, the standards and tellers you select should be climax species, capable of becoming strong, healthy veterans.



ABOVE: *This forest demonstrates coppicing with standards. The multistemmed trees were all grown from coppice stools and the medium-size, single-stemmed trees are tellers that will eventually grow into standards capable of producing valuable lumber.*

CONSIDER YOUR LONG-TERM GOALS

If you have a large number of trees, or multiple species capable of achieving standard status, it will be important to carefully consider your long-term goals. Unlike coppicing and other understory activities focused on annual cropping or short rotations, the standards represent a long-term investment. What might you like to use the standards for in the future? Building a timber frame barn? Making cabinets or other furniture? Growing a cash crop to pay for your child's college tuition? Or maybe the anxiety of the future is too much to consider — maybe you'd prefer to have standards that could be sold someday but in the meantime are simply a source of nuts or syrup (which can be produced from a surprising number of species).

SELECTING FUTURE STANDARDS

The successional stage of your woodlot will determine how you treat the tellers or standards. In a very young forest, it may be difficult to tell who the future stars are — those that are capable of achieving standard status. However, once trees reach the pole stage, natural thinning will have reduced some of the competition, thereby making the identification of tellers more obvious. Think of these trees as being in their most formative teenage years; this is the point at which their future success will be determined. As with human teenagers, the tendency is to try to give the budding tellers all the resources they need to thrive.

In the case of trees, the resource most often in demand is freedom, manifested as ample growing space. However, freedom for a tree can be as dangerous as freedom for a teenager. The tendency for tellers and aspiring standards is to respond to increased growing space by developing more branches. If the primary use of your standards is some purpose besides eventual lumber production, this may not be an issue.

If, however, your goal is to ultimately harvest tall, straight timbers for a barn or clear lumber for kitchen counters, training these trees to grow upward instead of outward is key.

QUESTIONS TO ASK

When Selecting Standards In Your Coppice Forest

- **Plant or tend?** Unless you're starting with bare ground, chances are good that your woodlot already has standards that can be tended, or tellers that may develop into suitable standards. Inventory these trees, recording location, species, size (DBH), and relative condition.
- **What's your goal?** The species of trees you select as standards should be in line with your goal, whether that be timber production, mast production, or simply a cash crop for the future.
- **Up or out?** Do the tellers or standards need upward training from their neighbors or growing space to thrive? This judgment is based on tree species, height, and the final product.
- **How will you protect your standards?** If your standards are in a location that's vulnerable to mechanical damage (such as a skid-trail intersection), consider using unacceptable growing stock (UGS) as bumper trees.
- **When to harvest?** Harvest your standards when they meet the specifications of the goods you're trying to produce. Harvesting of standards should coincide with an understory coppice harvest to prevent residual stand damage and increase efficiency.

TRAINING TELLERS

To train your tellers and standards to reach for the sky requires a bit of persuasion in the form of healthy competition. When you've identified a tree that's a good teller or potential standard, examine the other trees around it. Are there trees close by that are at approximately the same crown level? These intermediate and codominant trees are competition for your crop trees, but they're also providing a competitive atmosphere that keeps your chosen teller growing upward.

However, too much competition can be detrimental to tree health. As a general rule, if neighboring trees are touching the crown of your crop tree, cut them down! Retention of surrounding trees is fine as long as enough light is present to allow coppicing in the understory.

One of the advantages of converting an abandoned woodlot to a coppice with standards is that a lack of management has likely encouraged upward over outward growth. If you're lucky, you may discover that you have young standards or aspiring tellers that are ready to be released.

The process of releasing a tree from surrounding competition should be gradual; trees suddenly exposed to intense light may exhibit shock in the form of epicormic branching (dormant buds that sprout in random and often undesirable locations, such as the lower trunk) or leaf scorch. To avoid shocking your trees, consider removing competition over the course of one or two years.

AVOIDING INJURY TO TELLERS

Other important considerations in cultivating healthy standards include maintaining soil quality and preventing basal injuries.

Soil Compaction and Water Protection

In healthy forest soils, approximately half of the soil volume is air and water space. These physical qualities ensure adequate infiltration and percolation of nutrients and allow roots to grow both vertically and laterally. Working in your woodlot poses a potential threat to soil quality through compaction. Minimize compaction from equipment (such as tractors and forecarts) by following best management practices (BMPs). BMPs include:

- If you live in a cold climate, consider harvesting when the ground is frozen, as a way to avoid soil compaction and reduce the chance of erosion.
- Avoid building trails or skid roads through seeps and vernal pools, which are important breeding areas for amphibians and reptiles.
- Keep trails and skid roads on slopes less than 15 percent. If that isn't possible given the topography, install water bars, diversion ditches, or culverts.
- Never skid logs through a stream; consider building a portable bridge, or lay a series of logs and culverts parallel to stream flow for a temporary crossing. For more information

on stream crossing, contact your state Department of Natural Resources (or its equivalent).

Basal Injuries

As discussed in **chapter 1**, injuries to the base of a tree are generally associated with either fire damage or logging operations. Basal injuries to coppice trees rarely represent a health issue, since the trees are usually harvested before decay becomes a problem. However, basal injuries on tellers and standards represent a more serious issue, since these trees are typically grown for 60 years or more. This long life span also means greater risk of fungal and bacterial infections entering through a basal scar. One way to avoid this kind of injury is to leave high stumps from the competing trees you cut down around your valuable standards. These surrounding stumps become "bumpers" that protect your standards when logs are skidded through the forest.

Windthrow

In time, your released tellers and thinned standards will respond to improved growing conditions by developing a healthy crown and regular seed crops, at least in theory. At some point you will likely experience mortality of some tellers and standards. One common threat to standards is windthrow. In an unthinned forest, tree canopies are in contact with one another, offering a community support network. When competition is reduced to allow your standard to thrive, not only does it lose the support of the surrounding trees, but it also feels the effects of wind that, under prior conditions, would have been blocked by neighboring trees.

Once a tree is uprooted by windthrow, you have a limited number of options. In most cases, the practical solution is to harvest the tree for lumber, firewood, or some other homestead use. In some cases, the roots of windthrown trees may remain intact, creating a horizontal trunk capable of producing numerous epicormic branches that can be used for any of the small-diameter coppice applications described in this book. An additional use for these windthrown standards is to use them as mushroom cultivation sites (this technique is described in **chapter 7**).

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- **Up or out?** Do the tellers or standards need upward training from their neighbors or growing space to thrive? This judgment is based on tree species, height, and the final product.
- **How will you protect your standards?** If your standards are in a location that's vulnerable to mechanical damage (such as a skid-trail intersection), consider using unacceptable growing stock (UGS) as bumper trees.
- **When to harvest?** Harvest your standards when they meet the specifications of the goods you're trying to produce. Harvesting of standards should coincide with an understory coppice harvest to prevent residual stand damage and increase efficiency.

FAUNA IN YOUR FOREST

Collectively, your woodlot objectives and the successional stage of your woods will determine your options for creating wildlife habitat. Birds and mammals are the two main types of fauna you will be concerned with.

BIRDS

Generally, birds are considered an asset in coppice-with-standard systems. Among the most notable benefits of birds is their role as seed dispersers. Using wildlife to disperse seeds is a natural regeneration method that saves the time and labor associated with planting by hand. As birds consume fruits, the seed coats experience abrasion that aids in germination. One way to encourage seed dispersal by birds is to retain both snags and living trees in semi-cleared areas. These trees serve as roosts that increase the probability of seed dispersal and can accelerate natural forest succession.

Larger birds, such as wild turkeys, appear to play an important role in promoting the establishment of seed-borne trees, which may become standards in future woodlot rotations. As turkeys scratch at the forest floor looking for insects, fungi, and worms, they inadvertently create an important microenvironment for germination. The scratching action mixes organic material with mineral soil, which is necessary for many seeds to germinate.

Woodpeckers and Sapsuckers

Contrary to popular belief, woodpeckers do not generally attack healthy trees. Because they're actually in search of beetles, termites, and ants, they're most likely to peck at dying trees. Knowing this, you may wish to provide habitat to local woodpeckers if attracting them is one of your woodlot goals.

One simple method is to girdle a large but poorly formed tree in your woodlot. Girdling is done by chopping or cutting through the cambium of your targeted tree with an axe or chainsaw. If you opt to girdle with a chainsaw, use a series of three circumferential cuts approximately one inch apart, since the kerf of a chainsaw cut is narrower than that of an axe. Most trees will try to respond to this injury; therefore, make sure you remove a thick kerf of cambium so that the tree cannot heal. Cutting off the transport of nutrients eventually kills the tree and allows beetles, termites, and ants to move in. In an act of efficiency, woodpeckers will excavate cavities as they search for food. These cavities will be large enough to allow the establishment of nests.

Be careful, however, not to confuse the common red-headed woodpecker with its cousin, the sapsucker. Despite their name, sapsuckers do not actually suck sap; instead they bore a shallow hole in the tree that allows sap to flow to the surface, thereby attracting insects. Sapsuckers commonly establish forest routes where they move from tree to tree, boring small holes, and then return along the same route to pick off insects.

One way to differentiate sapsucker damage from beetle or insect damage is that sapsuckers will bore their $\frac{1}{4}$-inch to $\frac{3}{8}$-inch holes in straight, parallel rows, not randomly. Because sapsuckers go after live trees, you may wish to protect your trees, particularly if you have desirable standards or future crop trees. While chemical repellants exist, wrapping burlap around the attack zone seems to be an effective deterrent.

Succession Encourages Diversity

It's also worth noting that different successional stages of your coppiced woodlot will attract different bird species. In a study that examined the abundance of breeding migratory birds in an English mixed coppice woodland, it was determined that white-throated sparrows were most abundant one to three years after coppicing, but other species, such as the blackcap chickadee, were most abundant six to eight years after the coppice harvest.

Game birds such as partridge, grouse, and woodcock thrive in the early successional forest created through coppicing. After two years of growth, coppice sprouts offer enough protection that these birds often seek coppice stools as camouflaged protection sites. Occasionally, game birds will use coppice stools as nesting sites; because of this, coppice shoots should not be harvested during spring.

ABOVE: *Girdling can provide habitat for woodpeckers and cavity nesters while creating growing space for neighboring trees.*

MAMMALS

Not surprisingly, small mammals are greatly influenced by the coppicing cycle. Generally, the size of the animals is proportional to the successional stage; first to move in are mice, chipmunks, and squirrels, followed by rabbits and deer. While game species may be an attractive woodlot addition for hunters, the damage caused by these animals can be significant. The dense growth created in coppice systems provides protection, which discourages migration. The combination of protective habitat and an ample supply of young, succulent shoots can lead to significant damage to your woodlot.

Beyond hunting or trapping, one of the most effective means of discouraging browsing is by entering your coppice woodlot as frequently as possible. The presence of humans, hunter or not, still remains one of the greatest deterrents to animals. If excessive browse continues to affect regeneration in your woodlot, you can opt for either a physical barrier, such as a tree-saver tube or netting that covers young growth, or a spray repellent that reduces palatability.

COPPICING FOR FODDER

Another use for coppice systems is to grow fodder for livestock. In this section, "fodder" primarily refers to buds, early shoots, fruits, leaves, and young branches, which are both abundant in the woodlot and of nutritional value.

Choosing livestock to match your fodder options is an important aspect of developing a homestead that requires minimal external inputs. In the case of my high-elevation, high-latitude homestead, I've selected breeds that are not simply grazers but also browsers. Fodder can be either collected or browsed.

COLLECTING FODDER

Collecting fodder can be done more efficiently if it is combined with other woodland goals. For example, thinning red maple coppice stools makes for a tasty treat for my highland cattle and utilizes sprouts that ordinarily would be cut and left to decompose in the woodlot.

COLLECT OR BROWSE

Collected Fodder

Advantages:

- Efficient
- Amount harvested can be easily controlled
- Damage to parent plant may be avoided

Disadvantages:

- Time consuming
- Short feeding window after being harvested
- Gives animals less choice in their browsing diet
- Fencing systems (temporary or permanent) are needed

Browsed Fodder

Advantages:

- Can be combined with other objectives, such as land clearing
- No planting costs
- Perennial crops

Disadvantages:

- Potential for overbrowsing/indiscriminant browsing, resulting in plant mortality
- Animals may require supplemental feed

EXPERT PROFILE

A Master Bow Maker

Craig Milewski

Craig Milewski is a fish and wildlife professor, voluntary simplifier, hunter, backyard lumberjack, and bow maker. Craig grew up in rural North Dakota and spent his early years with farmers, foresters, and fishermen. This lot of outdoorsmen gave Craig an early appreciation for rural skills and nature's bounty.

Belying his modest demeanor are Craig's accomplishments as a primitive hunter. Craig doesn't hunt with guns or even compound bows. Instead, he prefers to use his woodlot as his woodshop for crafting handmade bows, with the goal of returning to that same woodlot for a hunt. For Craig, this nested relationship begins by combing his woods for clear, straight ash trees.

The trees need to be only about 4 inches in diameter, meaning that in many cases Craig is able to use coppiced stems. When selecting a tree, he looks for a straight section without knots or twisted grain. Once he's located a suitable tree, Craig uses his bow saw to cut out a 5-foot-long section, then uses a froe to split the log into a 2-inch-thick stave.

“Even the straightest of trees have a natural curve to the grain.”

Even the straightest of trees have a natural curve to the grain. By holding the stave upright and resting the bottom on his foot, Craig gently pushes on the center of the stave. As he pushes, the stave rotates to reveal the natural curve of the bow. From this point forward, Craig primarily removes wood on the “inside” of the bow. Removing wood on the “outside” would compromise the structural integrity. The two primary tools he uses to remove the wood are a drawshave and a farrier’s rasp. The drawshave is fast but poses the risk of run-off, where the blade cuts too sharply into the grain, compromising the overall strength.

Next, Craig marks out the handle and begins to bend the bow, noting areas of unequal thickness, which result in unequal tension. To make sure both ends of the bow bend equally, Craig makes long passes with a drawshave to even out the thickness, a process known as tillering. Once Craig is satisfied with the overall shape of the bow, he uses a round rat-tail file to carve the nocks, the grooves in which the bowstring rests at each end. The string is made from sinew, or stretched tendons from a previous year’s deer hunt. Craig uses linseed oil as a preservative on the bow. The final step, of course, will be returning to the woodlot to harvest a deer, hopefully just a few yards away from where the bow originated as a coppice sprout.

Shredding

Another technique that makes for efficient small-scale fodder collection is shredding (also known as “snedding”). Shredding is the removal of side branches on a tree. This process is usually carried out in late summer, when the leaves contain their highest nutrient levels. The shredded branches can then be fed directly to livestock (most commonly goats and cattle) or saved and piled as a winter fodder source. Oaks are commonly used as shredding material because of their leaf retention and high nutrient content.

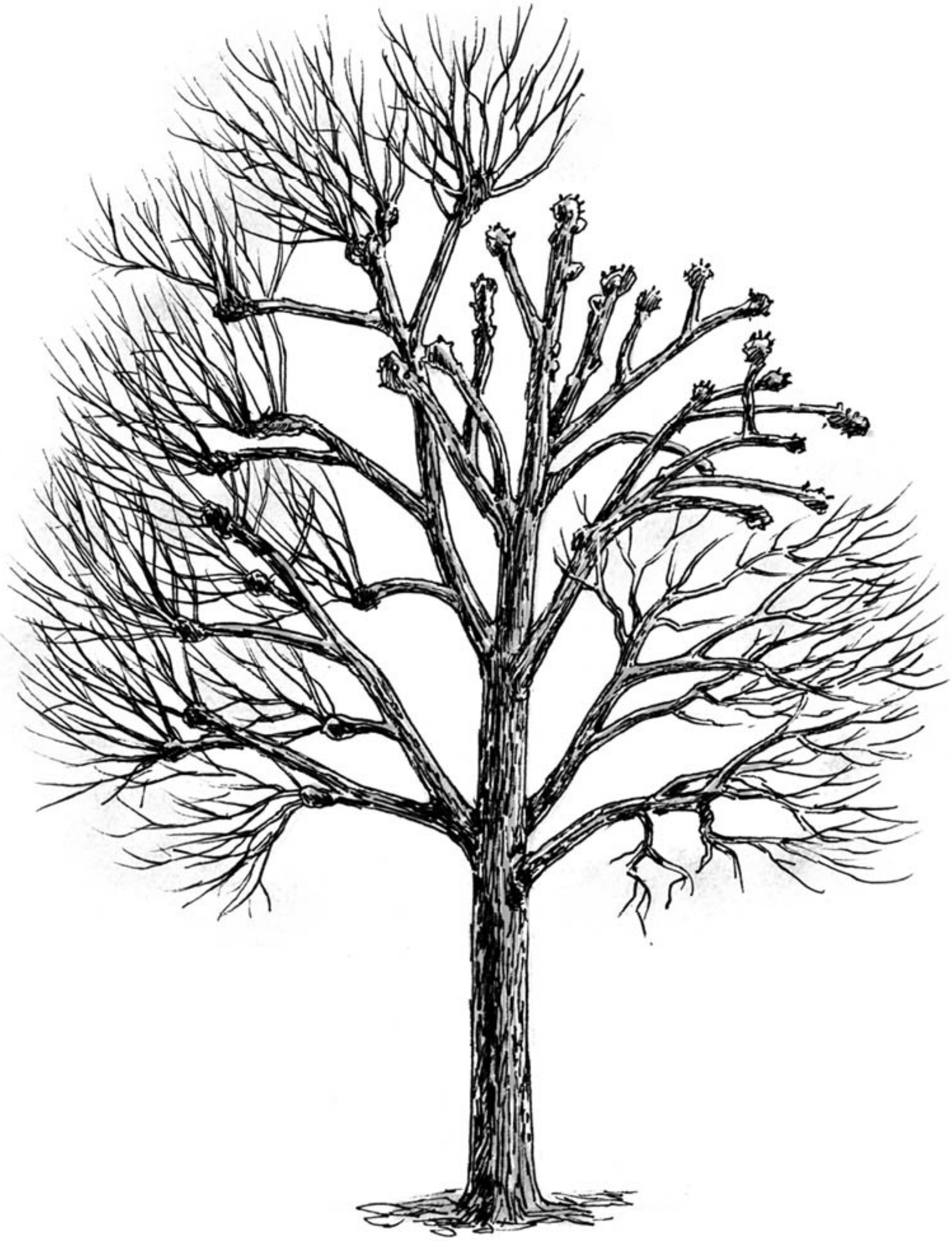
Traditionally, shredding was done to the entire stem of sapling and pole-size trees. This dramatic physiological change shocks the tree into releasing dormant buds capable of growing into new branches over a single season. One variation of this method would simply be less-aggressive pruning, intended to create clear wood or improve the form of a crop tree. It is important that any potential forage be researched to determine if it has toxic qualities. Black cherry, for example, contains a compound known as prussic acid, which can be harmful to livestock.

Pollarding

Pollarding is similar to establishing a coppice stool, only higher, so that the new growth is safe from grazers. When a tree has been pollarded over multiple generations, it will develop bare, scaffold limbs, with “knobs” at the end of each branch. These knobs are what produce abundant new, leafy growth. As with shredding, the goal is to produce tender sprouts and leaves suitable for animal fodder. The term “pollard hay” refers to the young growth, which is traditionally cut at two- to six-year intervals and either fed to livestock green or stacked in silage mounds for winter feeding.

Unfortunately, pollarding is often done carelessly with a machete or billhook (see **here**), resulting in unnecessary damage. By taking your time and following a few basic steps, you’ll preserve the health of the tree and be able to produce an abundant crop. Perhaps the most important precaution is to make sure the sprouts are removed at the base of the knob, which makes it easier for the tree to heal the wound. It’s also important to start the pollarding process when the tree is young so that you don’t have to cut limbs larger than 1 inch in diameter.

Over time, the knobs will develop, creating more dormant buds capable of producing large amounts of pollard hay. Finally, make sure that you select trees for pollarding that are vigorous and take well to pollarding; sycamores, beeches, oaks, and chestnuts are all good candidates.



ABOVE: *This tree illustrates the various developmental stages seen with pollarding. The lower right portion shows the crown prior to pollarding, and the upper right portion is after several subsequent pollarding treatments. The left side of the crown shows previously pollarded branches with new growth.*

BROWSING FOR FODDER

Rather than collecting the fodder yourself, allowing animals to browse offers the temping advantage of letting your livestock do the work. That temptation comes with a cautionary tale. You have to consider two factors — animal species and browsing duration — and integrate both as part of your grazing plan. The one exception, of course, would be if your goal is to eliminate vegetation in a specific grazing area. Assuming your goal is *not* to eliminate all vegetation from an area, then short, light browsing is best. Depending on the type of livestock and the size of your browsing area, this may be just a few hours or perhaps as long as a couple of days.

ABOVE: *Young green leaflets that emerge in early spring are a treat to livestock that have overwintered on hay.*

Developing an Animal's Palate

You will also find that different tree species have different levels of palatability. If you're trying to get your animals to consume a species they're less than fond of, you may need to move to a collection system in which the browse is mixed with more palatable feed. Over time, you'll be able to increase the ratio of browsing material until the animals develop a palate for browsing a specific type of fodder. I successfully transitioned my cattle and sheep to a feed mixture of 75 percent hay, 25 percent conifer browse by combining the two. I'm now able to toss a wagonload of conifer boughs over the fence and create an instant feeding frenzy. Before I introduced this fodder in their hay ration, they wouldn't touch it.

The way that animals browse will dictate whether you collect forage or allow browsing. My Highland cattle, for example, will consume woody stems up to ³⁄₈ inch in diameter. On the other hand, my blackface sheep are much more delicate, carefully removing the leaves without damaging the stem. This delicate browsing is, essentially, natural shredding.

Some livestock breeds simply won't browse, no matter how hard you try. The selection of livestock breeds on my homestead was highly intentional; it involved selecting the breeds and individuals from within herds best suited for a combination of grazing and browsing. In my case, this has meant raising Scottish Highland cattle, Scottish Blackface sheep, Mulefoot hogs, and Bourbon Red turkeys. Your specific location and available browse will inform which breeds are best suited for your homestead.

Browsing as a Supplement to Feed

Finally, it's important to note that browsing alone is not entirely sufficient for any livestock. On more than one occasion, I've heard livestock folks overpromise the virtues of browsing, leading one to believe that livestock could live on sticks alone. Instead, I would encourage you to view browsing as a symbiotic function that your livestock can play a role in: controlling vegetation while benefiting from nutrient-dense supplemental fodder. For more information on creating silvopastures, including browsing and grazing techniques, see **chapter 3**.

COPPICING FOR CHARCOAL

While European cave paintings drawn with charcoal indicate that charcoal dates back at least 30,000 years, it is not known whether the cave painters intentionally produced charcoal as a fuel source or simply found it as a by-product of wood fires. However, we do know that 4,000 years ago, charcoal became an essential and deliberate part of the economy, because it was used to smelt tin and copper to make bronze. The shift from smelting copper to making bronze required temperatures almost 572°F (300°C) hotter, but led to the development of essential tools such as the more durable bronze axe, which was used in both war and woodlot. These higher bronze-forging temperatures could be achieved only through the use of energy-dense charcoal.

By 1000 BCE, Europe had cleared much of its land for agriculture, using wood by-products for charcoal production. However, as the wood supply dwindled, the need for charcoal in bronze production, and eventually iron, led to the creation of coppice woodlots, specifically designed to yield high-quality charcoal. This is considered by many to be the most influential fuel in history.

Although virtually any wood species can be used to make charcoal, the most common species in coppice arrangements are alder, oak, and maple. (Hickory makes famously great charcoal but doesn't coppice very well.) For most people, charcoal is a by-product of other forest activities, and the wood that is used to fire your charcoal oven should be your "worst" firewood or, better yet, scraps left from other projects.

Charcoal can be used for a number of other applications besides barbeque. Both commercial and more primitive water filtration systems rely on the same basic charcoal-based technology to remove sediments, volatile organic compounds, and odors from water. One common method for remote off-grid homesteads employs a gravity-fed charcoal filtration system in which water percolates through a filter filled with ground charcoal, much like a drip coffeemaker.

Using the same process as the lump charcoal procedure described above, you can create charcoal pencils from the twigs, seedlings, and saplings removed as part of your regular tending operations. Load the pencils vertically in a 1-gallon paint can, fitting about 200 pencils per can.

The charcoal-cooking process results in usable by-products as well, beginning with the char-ash left at the bottom of the crucible. This ash can be used as a soil amendment to make acid soils more alkaline. If you choose to make charcoal out of softwood, the result will be a less energy-dense coal; however, you'll find the bottom of your crucible lined with a thick tar, roughly the consistency of caulking. This cement has historically been used for a variety of adhesive needs but is useful on the modern homestead as a patching material that sticks to virtually anything, including wood, metal, and cloth.

Charcoal Uses by Size

- **Fines.** This is the dust that's left in the bottom of the crucible after firing. Use for: water filtration, soil amendment, a slug-resistant garden border, or add to dish soap as a mild abrasive for cleaning metal.
- **Twigs.** Makes excellent pencils for charcoal drawings.
- **Medium lump charcoal.** Ideal for a woodland homestead BBQ.
- **Large lump charcoal.** An alternative to coal for blacksmithing. Burns faster than coal, but with without making "clinkers."

How to Make Charcoal

Charcoal is nearly pure carbon. “Cooking” wood in a low-oxygen environment releases water, hydrogen, methane, and even tar (in the case of softwoods). What’s left after the cooking process are lumps of coal that weigh about 25 percent as much as the original material that was placed in the crucible but are more energy-dense than the original “raw” wood.

Materials

55-gallon metal drum for the still

5-gallon metal paint can with clench-tab lid for the crucible (or for smaller batches, a 1-gallon paint can with lid)

Approximately 40 pieces of dry wood to fire the oven

Dry coppiced firewood 1 to 3 inches in diameter, debarked and cut into uniform pieces. You will need enough pieces to fill the can. This wood will become your charcoal.

Instructions

1. **Make your oven.** Convert your metal drum to a charcoal oven by punching holes in the lower third of the barrel. These holes can be punched randomly, as their only purpose is to provide oxygen to the fire inside.

2. **Construct the crucible.** The crucible, which holds the charcoal, can be constructed from the metal paint can. It’s

important that the can be clean. Layer the small, debarked firewood in the can, packing it as tightly as possible. The goal is to minimize the chance of combustion by minimizing air space. Drill a ⅝-inch hole in the lid of the can, and secure the lid using the metal clenching tabs. If your can doesn't have tabs or a closure band, you'll need to place a weight on the top, as pressure may build within the can.

3. **Build the fire.** Place the crucible inside the barrel. Because a fire will have trouble drafting well inside the barrel, you'll need to start a small fire and build it up slowly. Be sure to use untreated wood. Continue to build the fire so that it covers the sides and the top of the crucible, though you'll want to make sure that the hole in the top of it is unobstructed and visible. It is very important to keep the fire hot! To achieve the high temperatures required (a minimum of 500°F inside the crucible), you may need to split your firewood into smaller pieces that will burn faster but hotter.

4. **Cook the moisture out of the wood.** After 30 minutes or so, you will likely see steam wisping from the hole in the top of the crucible. This is the remaining moisture being cooked out of the wood. As your charcoal nears completion, a small flame will appear from the hole in the top of the crucible. As this last little bit of hydrogen and oxygen burns, you'll want to pay attention to the crucible flame. Once it goes out, carefully remove the crucible using long tongs, and immediately cover the hole in the top with a damp rag.

5. **Charcoal.** Once the crucible has cooled, it's time for the moment of truth. If you have tended your fire carefully and removed the crucible as soon as the flame burned out, you'll be rewarded with your own harvest of genuine lump charcoal.

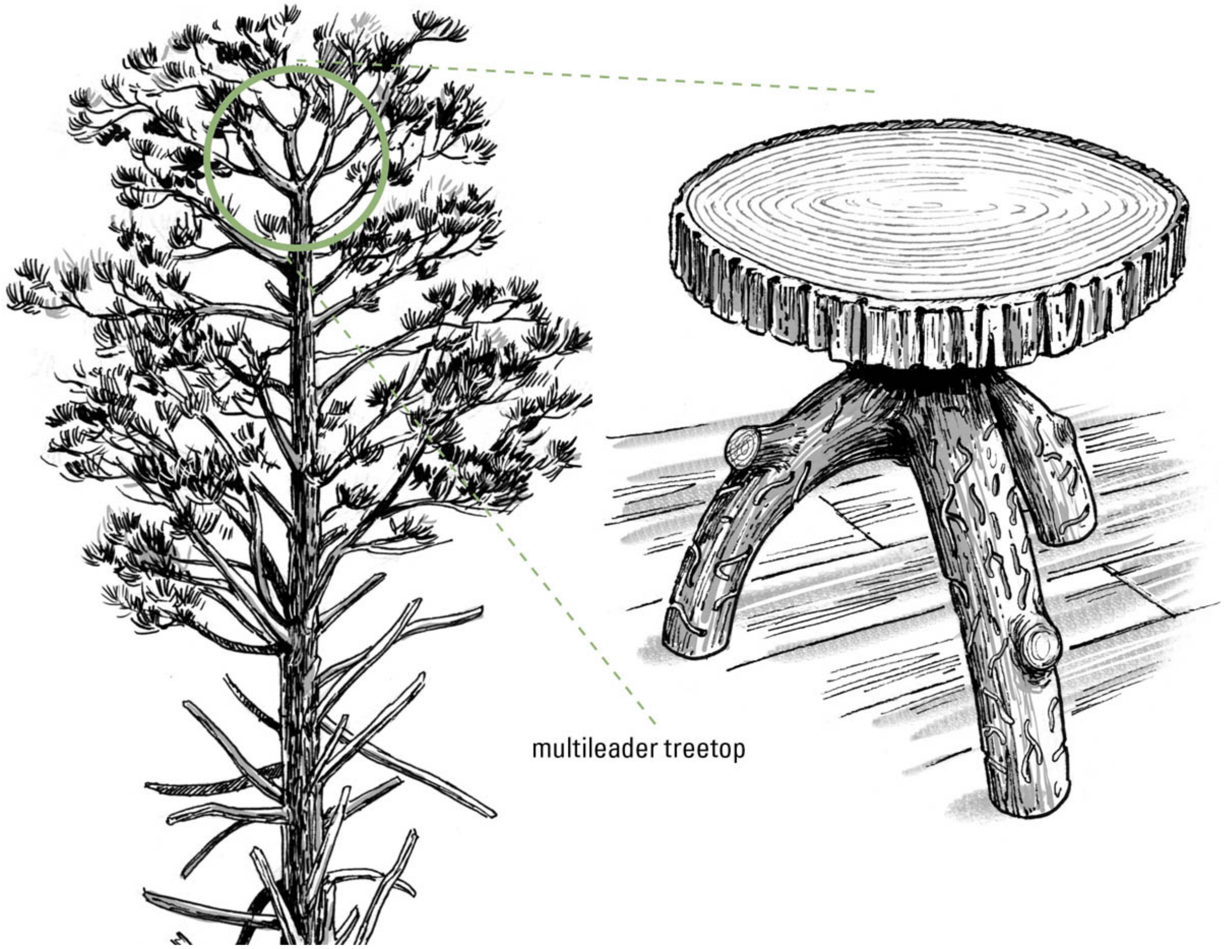
ABOVE: *Making charcoal from coppiced firewood can be done in an afternoon with easily salvaged materials. The quality of the charcoal produced is superior to store-bought briquettes that are made of compressed sawdust and burn quickly.*

FOREST FURNITURE

I hope by this point you're starting to see your forest less like a specialty store and more like a well-stocked general store. As you work in your woodlot, note the possibilities not only for fauna, fodder, and fuel but also for furniture. Admittedly, seeing this future furniture will require a bit of imagination.

UTILIZING WEEVILED TOPS

I'll use my own homestead as an example. Since a good portion of my woodlot was an abandoned Christmas tree farm, the two primary species were white pine and balsam fir, with small patches of red maple and gray birch. Unfortunately, much of the white pine had been infected by the white pine weevil, a parasitic beetle that deforms the tree by killing the terminal leader at the top. (Multistemmed tops are common in many tree species following damage to the terminal leader; mine just happened to be pine.) The tree responds to the death of this leader by allowing the branches in the whorl below to compete for the role of new dominant leader. These competing whorl mates form a bushy tree that has limited value as timber. Since I wanted to encourage species such as red maple and gray birch that are able to coppice sprout, I removed the weeviled pines and converted the inverted tops to stools, chairs, and table bases.



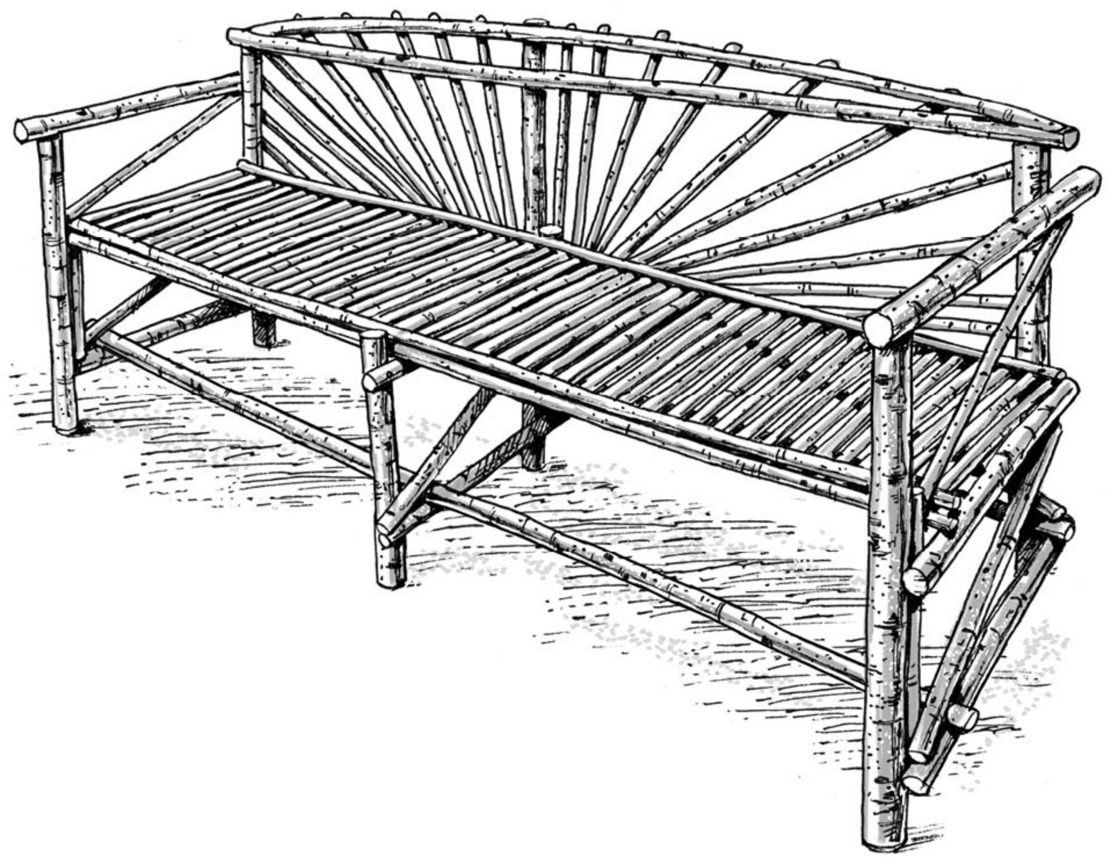
ABOVE: *Treat your woodland homestead like a home improvement store; look for burls for bowl making, curved branches for door pulls, and multileader treetops that can be inverted to make table bases and stools.*

GROW YOUR OWN FURNITURE

You could also employ your coppicing knowledge to *grow* multilegged stools and tables by coppicing taller stumps and selecting the three or four leaders that look most promising as stool or table legs. Obviously, this process takes much longer

(20 years or more) than simply selecting a tree from your woodlot that has already developed this utilitarian form, but it is worth mentioning for those interested in managing for a unique, long-term coppice crop.

If you're looking for more instant gratification, consider coppicing willow for bentwood furniture. Small-diameter willow can be coppiced on an annual or biennial basis. It can also be harvested as a by-product when thinning the sprouts on a coppice stool that's being grown as a longer-rotation crop.



ABOVE: *Coppicing willow allows you to sustainably harvest wood to make your own rustic furniture, such as this bench, in as little as two years.*

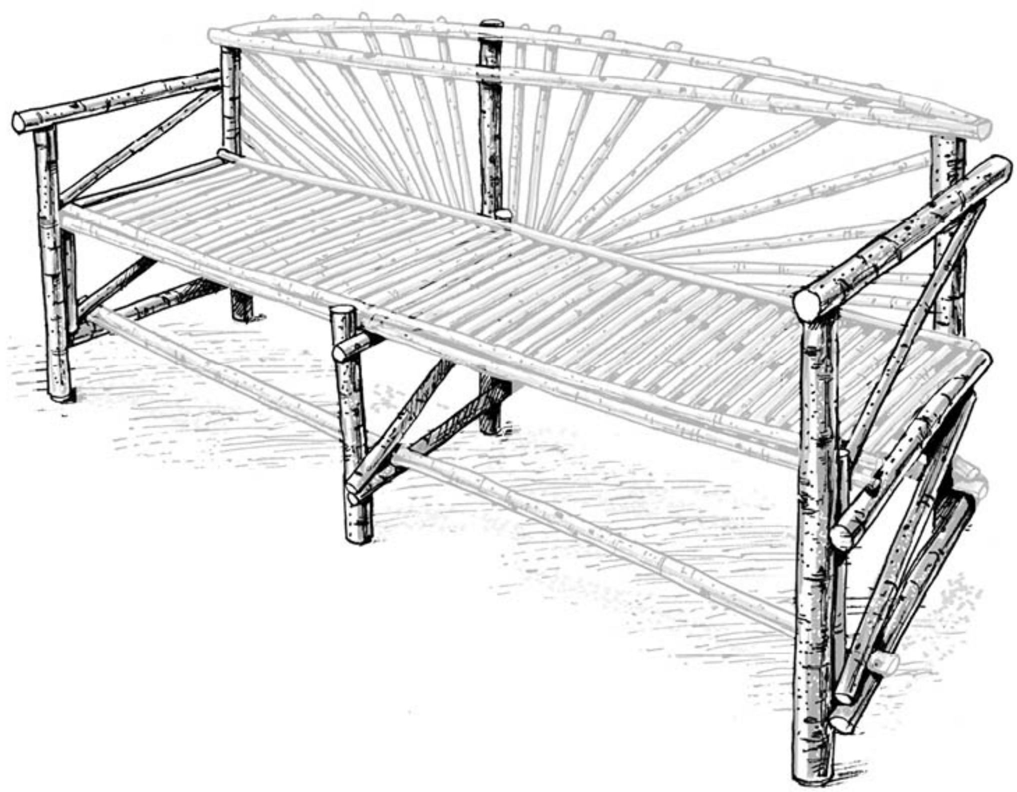
Tips for Harvesting Furniture Willow

- While willow may be harvested anytime during dormancy, many willow craftsmen prefer late winter just as the sap's starting to flow. The additional water content makes willow more flexible and easy to work with.
- If you don't have willow on your homestead, chances are good it grows on a roadside near you. Ask the local highway department if there's an area where you can harvest it. In most cases, they'll happily direct you to a line of roadside willows in need of pruning. If you live near a national forest, another option is to obtain an inexpensive personal-use harvesting permit from the forest service. In the event that you can't find willow, alder is good second choice.
- Get the right tool for the job. Pruning shears are fast but are only meant to cut material up to the thickness of a pencil. If the branch is bigger than a pencil but smaller than your thumb, use bypass loppers. For all material bigger than your thumb, use a handheld pruning saw.
- As you prune the branches, bunch them together and place them cut end down in a pail with water. This will help to retain branch moisture making them workable for several days after harvesting.
- Save your scraps! When you're done, you'll be left with a pile of green twigs. If you have goats, they will gladly snack on these woodland treats!

How to Build a Willow Bench

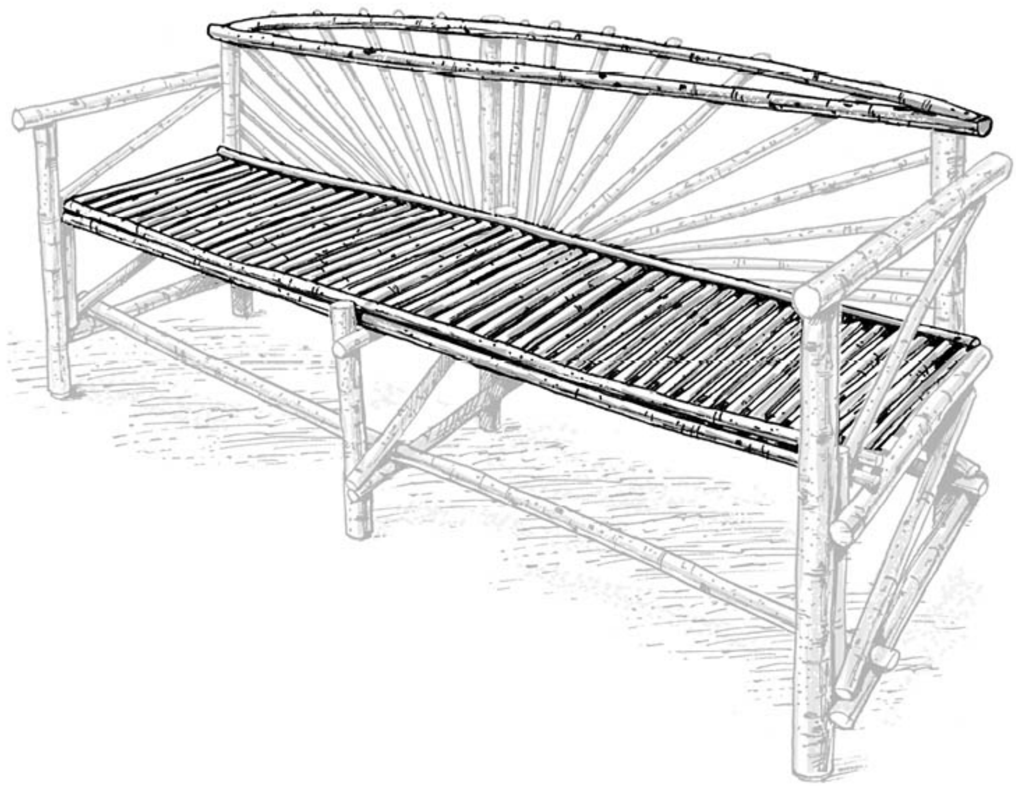
Instructions

1. Start by building the side frames of your bench. Work on a flat surface and pre-drill all of your holes. Lay down your front and back bench legs first, then screw the top and bottom rails, along with a diagonal brace, to the top of the two legs. Use deck screws that penetrate at least three-fourths of the way through the legs. Once you've made one end, you'll want to make two more side frames so that you have a middle support.

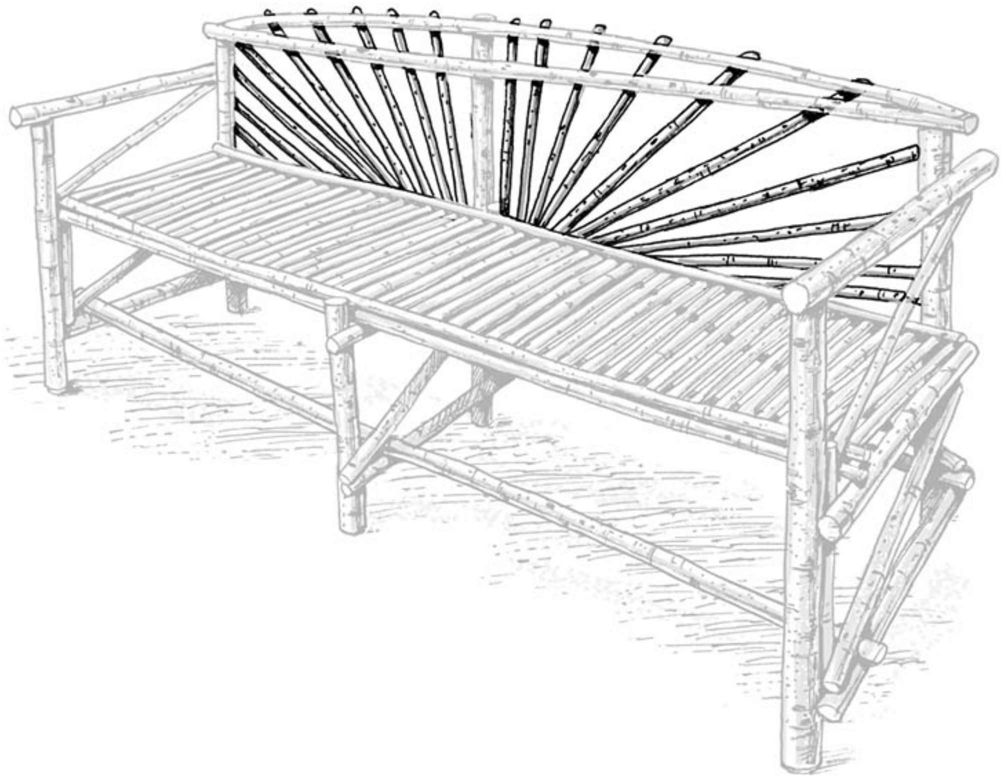


2. With the help of an assistant, stand up all three frames and screw two rails on the top (front and rear), then check to make sure that all the legs are vertical before screwing on the two lower rails. The rails should be screwed to both the legs and the horizontal supports. The longer you make the bench, the thicker the rails. Two inches should be the minimum rail diameter.

3. With the frame upright, you can screw the top rail along the back and begin screwing down the seat rungs, which should be spaced approximately 1 inch apart. Again, remember to pre-drill all the holes.



4. You're now ready to screw on the backrest. I prefer a sunburst pattern, though you could opt for vertical rungs or even a woven back. As a final step, consider adding a crossbrace on the front and back of the bench to add additional support. If you plan to leave your bench outside, it's a good idea to coat it with linseed oil, which will protect the wood while still allowing it to dry.



CHAPTER 5

Woodland

Structures

From Living Fence to Living Barn

Fences are an infrastructure item that receives relatively little fanfare in the establishment of a woodland homestead. This is unfortunate, given that fences are our best tool for keeping critters where they belong. By investing in good fences, you'll save yourself the frustration and time associated with herding independent-minded livestock. You'll also find that sound fences are the key to better land management, whether it be keeping critters out of the garden or concentrating chickens for mob grazing. Just as important as your fence is the shelter you provide for your animals. Living barns, stump sheds, and windbreaks use natural materials from your land to provide simple, low-cost protection that, best of all, doesn't require a single nail.

FENCING PSYCHOLOGY

When constructing a fence, either living or nonliving, you'll need to consider whether your defense is a physical barrier, a psychological barrier, or a combination. Physical barriers include barbed wire, woven wire, board fences, hedges, and other fencing systems that place a permanent, physical barrier between livestock and the prospect of freedom. Physical fences are often a good choice for creating perimeter boundaries and offer the comfort of knowing that their effectiveness isn't tied to an energizer that can fail for a variety of technical reasons.

Electric fences that require training for your livestock to become “fence wise” serve as psychological barriers. Many old-timers hang a piece of wet grass on the wires to “train” livestock to respect the electric fence. Not surprisingly, the animals are pretty quick learners!

Electric fences offer the benefit, over traditional physical fences, of deterring predators with a shocking jolt, and compared to other types of fences are generally easier to install over rough terrain. Permanent high-tensile electric fence offers the strength of a physical fence but is cheaper than options like woven wire.

On my own homestead, I prefer a combination of woven wire and two strands of electric fence, one at the top to discourage leaning over to browse trees/living posts, and a second at the bottom to discourage destructive grazing/fence pushing. Both of these lines are powered by a solar energizer that produces its maximum jolt in summer when discouragement is most needed! You may also opt for using an electric fencing system with your living fenceposts. These systems may be either temporary or permanent.

LIVING FENCE LINGO

Espalier. A French method of growing orchard trees by encouraging lateral branch growth along a series of wires. The resulting fence is known for early fruit production and easy harvesting, since horizontal, not vertical, growth is encouraged. Pleachers can be added between trees to create a tighter livestock barrier.

Gall. An outgrowth of plant cells often created through mechanical abrasion (e.g., branches rubbing in the wind). The result is a natural pleach through osculation and gall formation.

Hedgerow. A traditional, permanent living fence that, depending on construction methods, can serve a variety of purposes, including livestock control, protection of crops, privacy, and security.

Hurdle. A fence panel made by pleaching branches or vines. Hurdles, sometimes called “wattlehurdles,” can be tied together to form grazing and holding pens.

Inosculate. Osculate literally means “to kiss.” In the context of living fences, inosculate refers to the ability for branches to naturally graft, forming an impenetrable web of ingrown branches.

Pleach. To horizontally interweave branches or vines to create a basketlike fence. Pleaching is commonly used in the construction of hurdles. Live pleachers are the horizontal members in quickthorn hedges. Pleaching can also refer to the osculation or grafting of branches.

Snedding. The process of stripping side shoots and lateral buds from a tree or woody shrub as part of the hedge-laying process.

Wattle. A woven lattice strip that is usually made of cleaved, or split, saplings.

A SHORT HISTORY OF LIVING FENCES

For the woodland homesteader, it's somewhat baffling to consider how people usually build fences. They cut down perfectly healthy trees, break their backs digging holes and removing rocks, insert the cut-down trees, stretch the fencing material, worry about rotting fenceposts (because all nonliving wood eventually rots), and then replace the whole system 15 years later.

Interestingly, there are relatively few places in the world where this cut/dig/fence/replace model is actually practiced. While some grazing environments such as western rangelands don't have much of a choice — wood or metal fenceposts are necessary — most woodland homesteads have the options of employing some sort of living fence or live-tree system. Living fences have been used in Central and South America for over 2,000 years, and in Europe for at least 4,000 years.

Use of living fences in the United States goes back to colonial times. In fact, in his diary George Washington extolled the virtues of living fences at Mount Vernon, where he planted honey locust trees every 6 inches on center as a means of keeping livestock in and deer out. It should come as little surprise that Washington saw the living fence as a practical solution, given the long history of hedge and hurdle fences in the British Isles.

It's likely that the first living fences or hedgerows in Britain were constructed to keep people out as opposed to keeping animals in. Known as dead hedges, these rustic fences were laced with sharpened branches as a defense against attacks. Later, in the Bronze Age, living fences, or hedges, became an important tool for controlling livestock and delineating boundaries. These early hedges were strips of dense woodland that were left between fields as land was cleared and cultivated.

Eventually, the practice of hedging evolved into an art that in 55 BCE Julius Caesar described while observing the Nervi tribe in Flanders:

> *Cut into slender trees and bent them over so that many branches came out along the length; they finished this off by inserting brambles and briars, so that the hedges formed a defenselike wall, which could not only not be penetrated but not even seen through.*

The process Caesar describes remains essentially unchanged even today. Hedges proliferated in Europe largely because their utility extended far beyond simply keeping animals in; they were also a forage source for people and animals, and in some cases they even provided coppice firewood.

The late 19th century brought the development of barbed wire, a material that, unlike hedges (which took three to five years to establish), could be constructed in a single day. The transition to industrial-scale agriculture after World War II emphasized efficient use of land and highlighted the amount of productive land that was lost to thick, sprawling hedges. The argument for productivity eventually won out, and thousands of miles of hedgerows in both Europe and the United States were replaced with barbed and woven wire.

Fortunately, living fences are experiencing a renaissance in both Europe and the United States. In England, legislation now offers protection for existing hedgerows and incentives for constructing new hedgerows. In the southern, mid-Atlantic, and midwestern United States, the practice of growing Osage orange fences using the slurry trench technique described **here** is once again making for hog-tight fences.

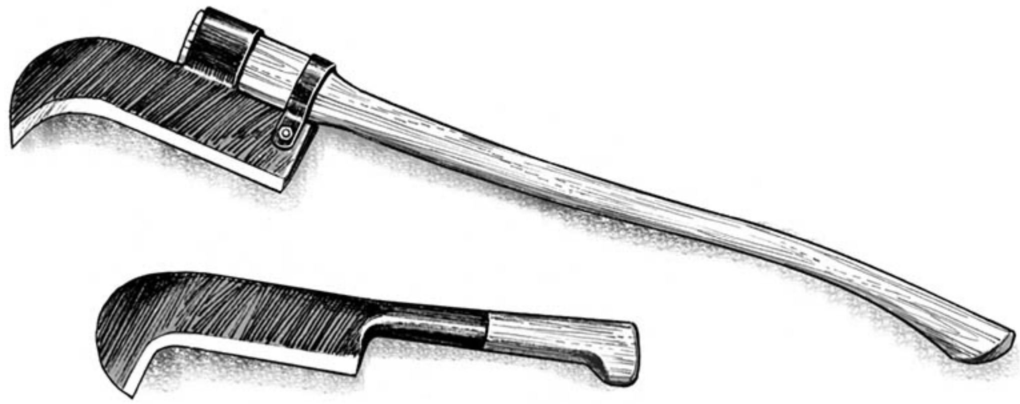
My own fascination with living fences originated in the Dominican Republic, where I worked with local farmers to create integrated agroforestry systems that provided both short-term and long-term benefits to rural communities. While some local practices were downright frustrating (pruning valuable mahogany trees with machetes), other practices were efficient and highly sustainable. One such practice was a system of horse-high, bull-strong, hog-tight living fences, many of which were more than 100 years old.

By blending both traditional living fences and modern fencing techniques, the woodland homesteader has a variety of options for constructing durable, economical, and visually appealing fences. In this chapter we'll explore a variety of living fence options, from rudimentary and rustic to innovative and impenetrable.

MASTERING THE BILLHOOK

A billhook is a traditional cutting tool that's best thought of as a cross between a knife and an axe. The J-shaped blade makes chopping against a rounded object (like a log) more efficient than chopping with a straight blade. The hook is also useful when shredding branches or cutting hedge pleachers. To use the billhook, make sure that you have a firm grip on the handle and that the blade isn't in the path of your body. Some billhooks are sharpened on the backside so that they can also be used for splitting.

A cousin to the billhook is the brush hook, which uses a long axe handle attached to a blade that resembles that of the billhook. This longer handle makes for more powerful swings that are able to sever multiple stems in a single blow. As with the billhook, make sure your body isn't in line with the blade, and be sure to use both hands.



ABOVE: *The billhook and its long-handled cousin, the brush hook, are essential tools for maintaining a living hedge. You'll also find them useful for clearing boundary lines and keeping shrubs from encroaching on trails.*

LIVING FENCES FOR THE HOMESTEAD

Geography, growing conditions, and culture have all contributed to myriad iterations of the living fence. In this section we'll examine two common living-fence options: the traditional quickthorn laid hedge and the inosculation hedge. It is the commitment of the fence builder, more than the fence style, that determines the strength of the fence. Also, remember that the benefits of living fences extend beyond livestock, so it may not be necessary to construct a hog-tight fence if it's simply meant to serve as a windbreak or produce forage material.

THE QUICKTHORN LAID HEDGE

Laid hedges (those that are planted, then cut, and "laid" over, as described **here**) are often referred to as quickthorns, with "quick" meaning alive and "thorn" referring to the barbs of many choice hedge species. It's worth noting that many quickthorn laid hedges use thornless species such as willow or alder, and are later reinforced with dead wood from thorny species such as locust or even blackberry.

ABOVE: *While a living hedge takes years to train and establish, it provides many benefits that a traditional fence never could, including bird habitat, erosion control, and windbreaks.*

An inventory of your woodlot will reveal potential growing stock for your living fence. If you're converting your forgotten forest to a pasture or silvopasture, consider the plants and trees that already exist in your proposed fenceline. Using trees and shrubs that already exist is always easier than planting new stock. If you're lucky enough to have Osage orange growing on your property, begin harvesting the fallen fruit as a seedstock source. As a livestock hedge, Osage orange is ideal thanks to its sharp thorns and dense branching habits. Willow also makes a great laid hedge, and cuttings are usually free for the taking.

Your other option is to purchase started plants from nurseries and then transplant them to your fenceline. However, whether you begin your hedge from seed or vegetative cuttings (placed about 9 inches apart), realize that building a hedge is a process that takes at least four (and often as long as six) years to establish. And while hedging is simple in theory, the hedge laying takes time and experience to master. For many amateur hedge makers, the first mistake is rushing the construction process; the second mistake is introducing livestock to the fence before it is fully established.

Despite the time and skill required to construct a living fence, the cost savings and ecological services offered are significant. If labor is available, a living fence can be built with only a minimum of tools (billhook, hatchet, anvil loppers, and bypass pruners) and without any purchased materials. In terms of ecological benefits, living fences, and hedges in particular, provide important edge habitat for songbirds as well as erosion control and, depending on species, even nitrogen fixing in the soil.

THE HEDGELAYER'S TOOLBOX

Scythe or brush saw. If you're resurrecting an old hedge, you'll want to clear the area on each side of the hedge to make it easier to work. If the undergrowth is woody (as opposed to grassy), consider using a brush saw to clean things up.

Billhook. Like any cutting tool, your billhook needs to be sharp to work well. Be sure to also maintain a stout bevel when sharpening; many people assume that they should thin the blade to allow the billhook to slice better. Unfortunately, this just encourages pinching and sticking.

Stakes. You'll need enough stakes to place one every three feet. The stakes can be cut from virtually any wood; many hedgelayers simply use scraps left over from thinning the hedge.

Ties. Part of the beauty of living hedges is that over time they grow to accept the form suggested by stakes and ties. For this reason, I recommend using natural, biodegradable materials such as sisal bailing twine that decomposes over the course of a couple of years.

Binders. Depending on the intended function of your hedge, you may opt for binders as a way to add strength and beauty to your hedge. Long (16 feet or more), 1-inch-diameter “whips” are best as binders, thought shorter pieces may be lashed together.

HEDGE LAYING 101

More than two dozen quickthorn laid hedge designs and methods exist, but most are variations of the same basic method. Hedge laying is an activity performed while the hedge trees are dormant and the sap is down. The assumption here is that you have established stems at least 8 feet tall that are about 9 inches apart.

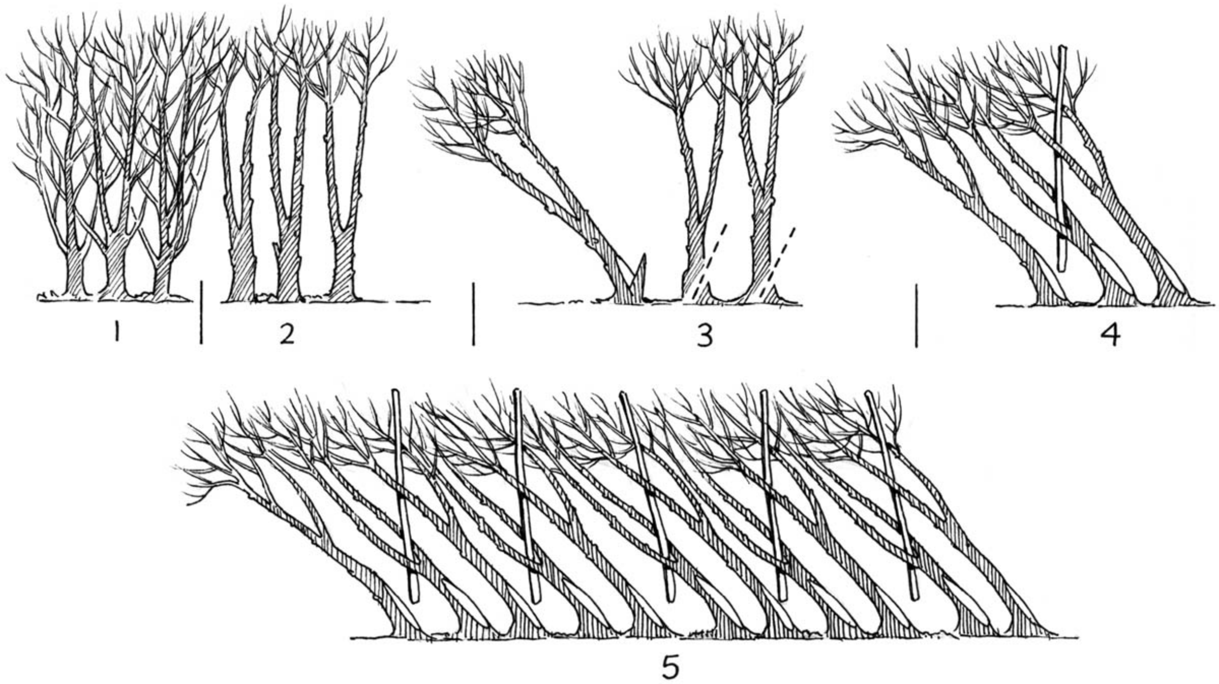
Trim. Begin by trimming underbrush that would interfere with the pleached stems receiving sunlight.

Bend and slice. Start with the first hedge tree, whose stem will become your first pleacher, and use a billhook to slice the base of the tree with a downward diagonal cut. The cut depth is usually one-half to two-thirds of the diameter of the base. Much of the art of hedging is knowing how far to cut, which will vary based on species and diameter. If you don’t cut far enough, the stem will snap; if you cut too far, the stem won’t receive enough nutrients and will die. The U.K. National Hedgelaying Society offers useful advice on this particular point in their publication, *Hedge Laying Explained* (see **Resources**).

Bend the partially severed stem toward the next tree at a 40- to 60-degree angle. If the stem breaks while bending, it’s best to trim the stem at the ground, allow it to coppice sprout, and recut the following year.

Tie and bind. With the pleacher stems cut, insert 1- to 2-inch-diameter stakes, 10 to 12 inches long, at 3-foot intervals and tie the pleachers to them at the prescribed 40- to 60-degree angle. For the ties, biodegradable materials such as baling twine are preferred to metal ties since the pleachers will “learn” to grow diagonally in short order. If your stems are planted particularly close, you may choose to retain some stems as uprights for attaching cut pleachers.

To add extra strength to your hedge, consider adding “binders” or “heatherings,” which are woven in a spiral pattern between the upright stakes, giving rigidity to the overall structure. Common binder woods are birch, ash, willow, hazel, and grapevine.



ABOVE: *Hedge laying should be done in late winter or early spring before the plants leaf out. Experienced hedgelayers can build up to 60 feet of hedge per day; set more modest goals on your first attempt.*

VARIATIONS OF THE QUICKTHORN LAID HEDGE

Like most art forms, hedge laying has evolved into countless iterations that express both place and purpose. The quickthorn laid hedge techniques described in this section illustrate innovative approaches that may prove useful in the development of your living fence.

Midland Bullock

As the name implies, the Midland Bullock method was developed to fence cattle. Several construction features make this a particularly durable fence. First, dead brush is placed on the interior of the hedgerow to deter the cattle from browsing the new growth. Second, binding is placed below the top of the hedge so that cattle can't disassemble the fence with their horns. Finally, the back side of the hedge is kept neat and free of excessive growth, to allow maximum space for adjoining crop fields.

Derbyshire

As with the Midland Bullock, brush is placed on the livestock side of the Derbyshire hedge to discourage browsing on the hedgerow. This fence is common in both sheep pastures and multispecies grazing arrangements. It uses sawn stakes, which can be made from edging scraps from a sawmill. The stakes should be placed reasonably close (18 to 24 inches apart), with pleachers woven tightly between the stakes. This tight weaving pattern means that no top binding is necessary.

Lancashire

The Lancashire technique is unique in that it uses a double row of alternately placed stakes. The pleachers run down the center of the stake rows with the branch growth from the pleachers pulled and woven around the stakes.

Brecon

The Brecon technique uses a single row of stakes down the center of the hedge. When used with older and larger hedge material, the stumps are allowed to coppice sprout and grow for eventual use as pleachers. To protect the coppice growth, dead wood is placed around the stumps to discourage browsing. Additionally, pleachers are loosely woven around every stake, creating a protective bow for the coppice stump.

Yorkshire

Commonly used as a sheep hedge, the Yorkshire hedge has a dense base and a center row of stout stakes that has a rail either nailed on top, or on each side of the rail, to create a binder and slot through which the pleachers can run. Because this fence is low and susceptible to browse, it should be used on a rotation basis, allowing for regrowth.

Cornish

In the windy Cornwall region of southwest England, a distinct hedge system is used where an earth bank is faced with stones. Shrubs are planted on top to extend the height of the windbreak. In a variation of the Cornish hedge, used in the New England states, soil and rubble are placed in the center of a stone wall and then cultivated with rose or other thorny shrubs. However, it should be noted that the root action caused by plants growing within stones will, over time, cause the fence to lose its batter, bulging outward.

Isle of Wight

Perhaps the crudest but most utilitarian of hedges, the Isle of Wight is an untidy but hog-tight fence. If you're in need of a living fence in short order, this is your hedge. Pleachers are crisscrossed atop one another and pegged down with stakes. This is among the widest of hedges, often measuring 20 or more feet in width. This method may be suitable for repurposing seminatural hedges that may lack the appropriate pleacher density for other hedgerow designs.

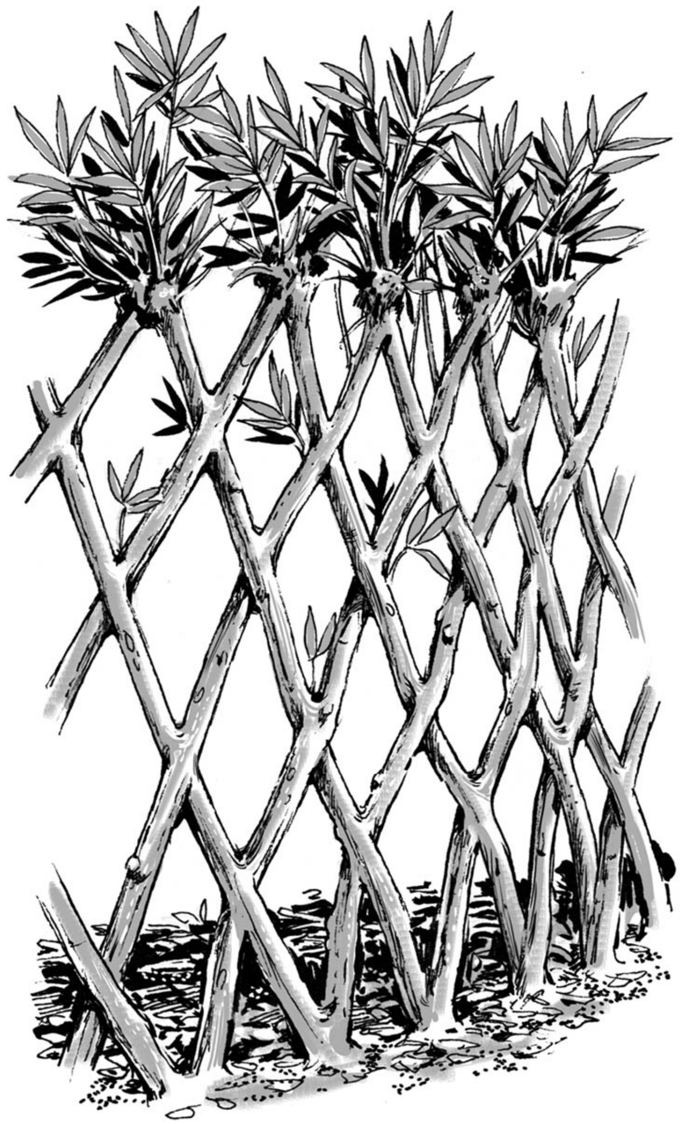
INOSCULATION HEDGES

While the quickthorn laid hedge relies on rapid growth to create a tight fence structure, inosculation fences use branches' self-grafting abilities, triggered by abrasion, to form a physical bond. When selected branches of young trees or shrubs are tied or braided together, the touching bark is worn away as the branches move in the wind, and the branches then begin to grow together. The bark may also be cut to speed the process.

This grafting of branches results in a living fence that, even when heavily browsed, will remain impenetrable.

Further examination of George Washington's diary indicates that the fence he was ultimately trying to build was a honey locust inosculation hedge with "entwining branches." Letters to several of Washington's farm managers indicate that the project never took priority, especially when farm managers were given access to milled lumber for constructing board fences that promised instant gratification.

In other parts of the world, inosculation has been used for constructing not just fences but also entire villages. Many coastal areas of medieval Europe show evidence of inosculated trees planted as a geometric orchard. The limbs of these trees were then inosculated to form a flat, interlocked canopy that was then used as a platform on which rustic huts were constructed. This illustrates not just the physical strength associated with this method but also the ways in which the grown environment can equal, if not trump, the built environment.



ABOVE: *An inosculated hedge gets stronger with time as branch grafts form solid unions.*

CREATING AN INOSCULATED HEDGE

Inosculated hedges can be created either from an existing hedge or as part of the establishment of a new hedge. If you'd like to inosculate a new hedge, you have two options: you can either construct a **quickthorn laid hedge**, or you can plant willow (or similar species) in a tight spacing arrangement (4 to 6 inches apart) and inosculate the lateral branches. Either way, once the hedge is established, begin training potential inosculation branch mates. Note branches that are growing in a potential opening or escape route as future inosculation candidates.

Inosculation is most successful if the match among branches is made in early spring, prior to leaf-out, but once the sap starts flowing. As a general rule, inosculation is easier and more successful on smaller branches than on larger ones. Some trees respond to inosculation best if the bark is lightly abraded using a fine rasp. Other trees (particularly willow) seem to prefer clean mating surfaces that result from using a sharp knife to expose the inner bark of each of the mating surfaces.

Once you've prepared the branch surfaces, bind the mated branches together so that the point of union can't move. You can use paper-coated twist ties, thick rubber bands, electrical tape, or self-fusing splicing tape to hold your newly joined branches together. You may discover that in order to keep the branches from moving or shifting, you'll have to add bracing, in the form of additional ties or stakes, to prop and train your branches.

Inosculation will occur over a single growing season; however, it will take several years for a cellular gall to form between the mated branches. Removing restrictive ties and replacing them with larger or expandable ties will also help ensure clean binding between the mated branches.

TREES FOR LIVING FENCES

As a general rule, trees that are vigorous coppice species also tend to be good candidates for inosculation. While inosculating trees from the same species is most common, it's also possible to perform the same procedure with trees from different species, or even with a conifer and a deciduous species (though this is fairly rare). The following chart illustrates those species best suited for inosculated living fences.

Common Name	Scientific Name
American beech	*Fagus grandifolia*
American chestnut	*Castanea dentata*
American elm	*Ulmus americana*
American hophornbeam	*Ostrya virginiana*
Apple	*Malus* spp.
Black ash	*Fraxinus nigra*
Black birch	*Betula lenta*
Black cherry	*Prunus serotina*
Black locust	*Robinia pseudoacacia*
Dogwood	*Cornus* spp.

Common Name	Scientific Name
Fig	*Ficus* spp.
Live oak	*Quercus virginiana*
Osage orange	*Maclura pomifera*
Paper birch	*Betula papyrifera*
Poplar/aspen	*Populus* spp.
Red alder	*Alnus rubra*
Red maple	*Acer rubrum*
Rowan	*Sorbus aucuparia*
Sugar maple	*Acer saccharum*
Willow	*Salix* spp.

REINFORCING HEDGE FENCES

The primary challenge with hedge fences is that you'll likely need fencing long before your hedge is livestock ready. A hedge may fail if you introduce livestock before the hedge is mature enough to withstand the pressure.

Reinforcing with Polywire

Portable electric fences are your best bet for protecting your new hedge. To dissuade your livestock from exploring or nibbling on the hedge until it has time to fully establish, consider erecting a single or double strand of electric polywire on the inside of the hedgerow. Polywire is a flexible ropelike material that is twisted with metal wire for use in portable electric fencing systems.

Choose the right solar energizer. If your hedgerow is a good distance from an electrical source, you may want to use a solar electric energizer. The livestock species that you're grazing will dictate whether you need a single or double strand, as well as the size of the energizer. Horses and cows will respect a single strand inside a new hedge, as long as the fence is powerful enough and they have ample feed *inside* their grazing area. Sheep usually need two stands since their size makes them candidates for going both under and over the fence. For standard goats, consider using a polynet arrangement 4 to 5 feet high.

Many homesteaders lament how their livestock escaped a "perfectly good" electric fence. The electric fence may be fine, but the energizer units might be undersized or have a poor ground, leading to a weak charge. In northern areas where the days are short in late fall, early spring, and winter, a solar energizer that works well in summer is inadequate the rest of the year.

Keep grass short. The other major issue with using an auxiliary electric fence within the perimeter of your hedgerow is the interference of grass and weeds, which can draw voltage, making for a weaker fence. By mowing or trimming before you establish your temporary electric fence, you can avoid this voltage interruption.

Once the hedge is established, you may choose to remove the electric energizer and drape the unelectrified polywire over the hedge. Most livestock will associate the wire with the displeasure of being shocked and steer clear!

Filling in the Gaps

You may discover that there are sections of your hedgerow that refuse to fill in. While master hedgebuilders would fret at the suggestion, using dead wood to block these openings may be your best bet, at least as a short-term solution. Another option is to do an "enrichment planting," in which additional trees or shrubs are intercropped in the gaps.

OSAGE ORANGE SLURRY FENCE

If you're fortunate enough to live in a part of the country where Osage orange grows, you need not look further for fencing options. While the native range of Osage orange is limited to Texas, Oklahoma, and Arkansas, it has been successfully cultivated in all but the most mountainous regions of the United States. Osage orange wood is rot resistant and makes fabulous fenceposts. It can also be used as a living fence that can be cultivated from seed, shoots, or suckers. If Osage orange grows in your region, but not on your homestead, consider asking someone who owns a few trees if you can collect fruit in the fall for your fencing project. In most cases, landowners will be pleased to have the fruit cleaned up.

Begin by filling plastic buckets approximately three-quarters of the way full with Osage fruit. Drill a series of small holes near the top of the bucket to allow water to drain, while preserving the seed slurry inside. A 5-gallon bucket is sufficient for 25 to 35 feet of single-row fence.

Before the ground freezes, dig a 5-inch-deep trench outlining the proposed fenceline. If you intend to house sheep within your living fence area, consider digging a second trench 2 feet apart from the first trench. This will give you a double fence.

Leave the buckets exposed to the weather; freeze-and-thaw cycles will help break down the fruit and expose the seeds.

In the spring, once the threat of frost has passed, you can apply your slurry. If it's been a wet winter, you can simply mash up the fruit with the water that has accumulated in the bucket. In the event that the slurry is dry, add water and mash until it's the consistency of a milkshake.

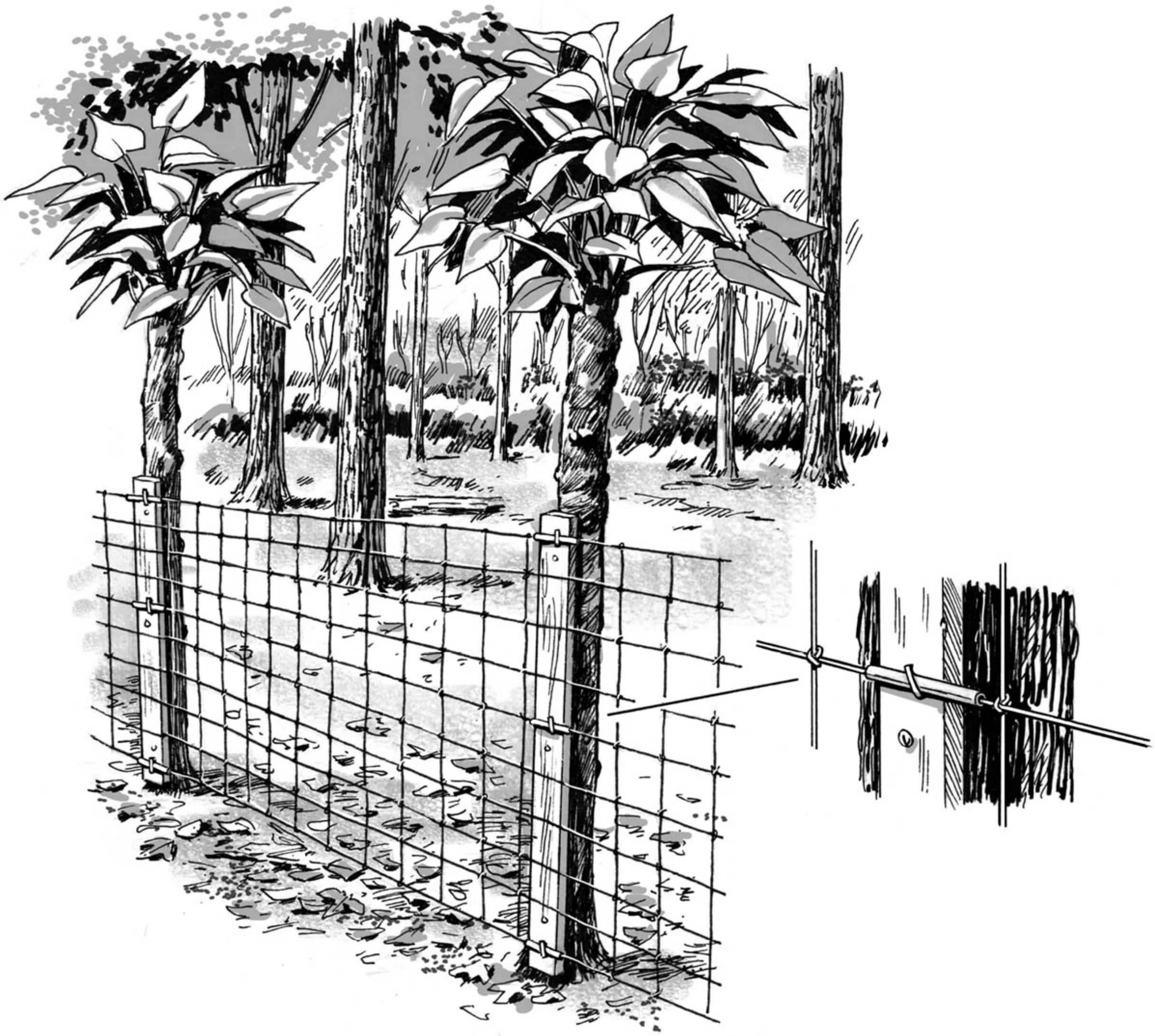
Pour the slurry into your trench and backfill with no more than an inch of soil. Continue to water the fenceline through germination and establishment.

Because of the aggressive coppicing behavior and the stout thorns of Osage orange, many people allow a natural vertical hedge to form instead of going to the trouble of cutting horizontal pleachers. In doing so, you'll want to prune your hedge in a way that encourages density over height. Given the species' rapid growth, annual pruning is necessary, with the pruned clippings making great animal fodder.

THE LIVING FENCEPOST

If hedge building seems like too laborious an undertaking for your woodland homestead needs, consider living fenceposts as an option that can save you time and money. In traditional fence construction, approximately three-quarters of the time required to fence an area is devoted to the installation of fenceposts. If you're creating a silvopasture or pasture area, chances are good that your boundary is lined with trees. If the trees along your fenceline are well established and firmly rooted, they'll likely make good living post candidates. If your pasture is devoid of trees, has only very small trees (seedlings), or has shallow-rooted trees, you may need to plant trees as future living fenceposts.

Unrolling a spool of barbed wire and haphazardly stapling it to trees throughout your forest or pasture may bring instant gratification, but it will ultimately result in regret. There are several problems with attaching fence material directly to living trees. First is the obvious consideration that you run the risk of limbs (or even entire crowns) breaking and crushing your fence below. The other problem is that as the trees grow, both the staples and the fence wire become ingrown, rendering the first log in the tree useless for lumber. Finally, if the trees selected as living fenceposts aren't wind firm, they may uproot and take a section of fence with them. Fortunately, there are several techniques that can help you to grow trusty and durable fenceposts.



ABOVE: *Living fenceposts are kept in the juvenile stage by pollarding the crowns. Intentionally keeping the tree short reduces the chance of windthrow or of large limbs falling on your fence. The board-mount method shown is further explained* **here**.

POLLARDING FENCEPOSTS

Pollarding is a pruning practice in which a tree or living post is maintained in a short, juvenile stage that promotes a dense head of foliage and branches. The same basic process has been practiced in Europe since medieval times and is now used in both temperate and tropical regions with coppice species.

Pollard fenceposts not only require little maintenance but also produce livestock fodder. The biennial pruning required to maintain the pollards results in trimmings that can be fed to animals — what was once known as pollard hay. Longer intervals between pruning (8 to 14 years) result in larger logs that can be used to make fence rails, stakes, charcoal, or firewood.

Since pollarding is essentially elevated coppicing, all of the same species and rules apply. However, unlike with ground-level stool coppicing, the root system of pollard trees has to work harder to get water and nutrients up to the new growth. By judiciously pruning the lower branches, you're not only ensuring the flow of nutrients to the crown but also discouraging browse by curious livestock.

Using Barbed Wire

Pollarded trees generally live longer than unpollarded trees because they are kept young with small crowns that are less likely to suffer windthrow (which would damage your fence below). Since the size and form of pollarded trees generally prevent them from ever being used as timber, it is not uncommon to see barbed wire attached directly to the tree. As with all manufactured fencing, quality varies greatly. Be sure to consider wire gauge, barb number and length, and coating material when purchasing. If you opt for using barbed wire with your living fenceposts, review the spacing and height recommendations in the chart below.

USING BARBED WIRE WITH POLLARD FENCEPOSTS

Species	Maximum Strand Spacing	Minimum Fence Height	Minimum Number of Strands
Pigs	4"	2'	5 (first strand should be placed at ground level to discourage rooting)
Sheep	6"	4'	8 (optional strand at 2" to deter predators)
Goats	6"	5'	10 (optional strand at 2" to deter predators)
Cattle	12"	5'	5 (cattle vary in temperament; adjust according to your herd's behavior)

Using Woven Wire

Beyond barbed wire, a variety of other fence materials may be used with living posts. It is worth noting that barbed wire should not be used with horses because of the risk of lacerations. Woven wire is a good choice for multispecies grazing systems because the openings are small enough that you can graze virtually any size/breed of livestock. It also offers the advantage of being impenetrable by many predators.

If you're going to build a fence you'd like to last for as long as possible, purchase high-quality materials. Quality varies widely with woven wire fencing, so be sure to read the label.

Quality woven-wire fence is heavy gauge (very thick) and contains copper, which makes it elastic (able to expand and contract based on temperature) instead of brittle. Buy once, cry once.

The Living Fencepost, 1816 Style

In 1816 the Philadelphia Agricultural Society conducted a study that looked at options for "living trees connected with rails of wire." This economic study concluded that over a 50-year period, farmers would save $1,329 per hundred acres enclosed if they used living fenceposts instead of traditional fenceposts that would need periodic replacement. The study went even further, suggesting that with the fruits, nuts, and firewood being produced by the living fenceposts, a farmer could theoretically harvest $396 per year per hundred acres enclosed — a sizable income in early-19th-century America.

STARTING WITH TEMPORARY FENCES

I'm a fan of starting all pasture projects with temporary electric fences that use step-in posts. Temporary fences allow you to try out different arrangements and consider the most practical locations for gates, holding pens, and cross-fences. The type of livestock you have will determine which temporary fencing system is best. Polystring and polyrope are among the most affordable options, but they should be used in conjunction with an adequately sized energizer (erring on the side of larger) since the conductive “hot line” is only a single strand in the fence. For horses, a single or double strand of high-visibility 1½-inch polytape is adequate, though polytape has a tendency to develop sags in the snow and rain if it isn’t properly tensioned.

Once you’ve experimented with temporary fencing to determine your ideal pasture arrangement, see what trees might exist that can be used as living fenceposts. It’s okay to have a mix of living and dead posts. Dozens of temporary fence connectors and insulators exist; however, the use of permanent, living posts means that you should purchase quality hardware that can be adjusted as the tree grows.

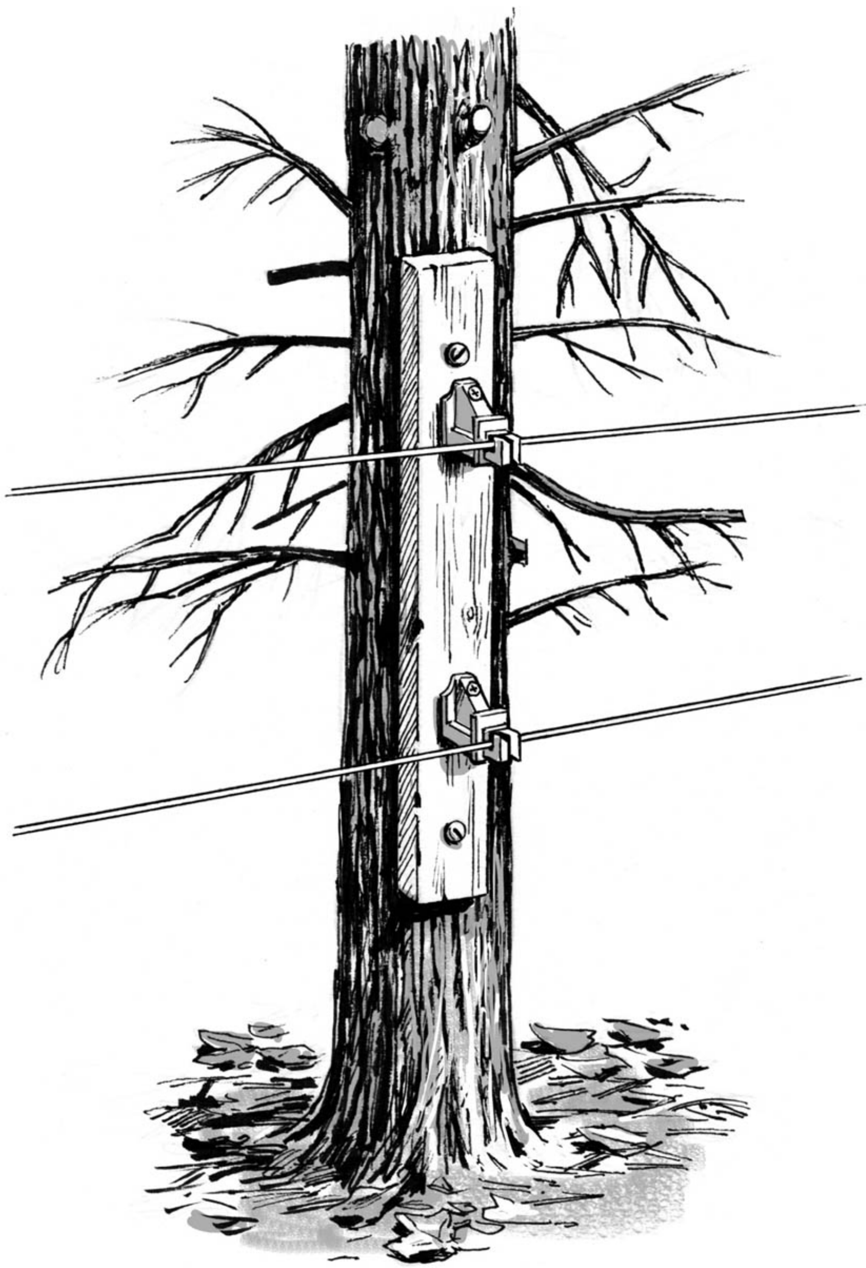
MINIMIZING DAMAGE TO LIVING FENCEPOSTS

So how do you minimize damage to your living fencepost while still installing the necessary hardware, such as insulators? First, if you have a choice of stainless-steel or galvanized over untreated hardware, go for the stainless or galvanized to minimize rust. Second, if you have the option of screw-in versus nail-in hardware, choose the screw-in option. The screw-in hardware uses treads, not the head, to hold it in place; this means that you can partially screw the fencing hardware in, allowing the post to continue to grow while still having a firm mounting point. If a nail is pounded flush, you’ll likely find the head of the nail beginning to fold over in just a few years, which ultimately results in broken hardware and an additional compartmentalization wound for the tree.

However, perhaps the best option for securing insulators and other fence hardware to living posts is the board-mount method. This approach uses short sections (about 2 feet) of pressure-treated 1" × 6" boards mounted to your living posts with galvanized ring-shank 20d nails or polymer-coated deck screws. The insulator is then connected and either screwed or nailed to the board. As the tree grows, it pushes against the board, but your insulators don't run the risk of being enveloped by the growing tree. I suggest ring-shank nails because they tend to resist being pushed out by the growing tree whereas smooth-shank nails do not.

If your living fenceposts are not pollarded to be short and stout, you run the risk of windthrow since fencerows experience great wind turbulence. On the other hand, if your fencerow is made up of ancient maples or towering pines, you may not have a choice in selecting your living posts, and pollarding may be a century too late. In that case, you should consider pruning all dead and dying limbs out of your living fencepost trees before erecting your fence. Also, in selecting trees for living fenceposts, favor those that lean away from the pasture to reduce the chance that a broken or blown-out top will land on your fencerow. Another strategy is to prune, or raise the crown on, the fence side so that the tree not only develops a natural bias to fall away from the pasture but also reduces shading for sun-loving grasses and forbs.

In the event that your living posts are of coppice stock, you may want to consider training and selecting leaders so that the stems facing away from your pasture are reserved for firewood production, while the forward-leaning sprouts serve as your living fencepost. These can be maintained as pollard posts that conveniently lean into the pasture; pollard hay will then literally fall at the feet of livestock as it's cut.



ABOVE: *Mounting a board to your living fencepost means that as the tree grows it will push against the board, instead of growing around your fence hardware.*

FORMERLY LIVING FENCEPOSTS

While living fenceposts present the opportunity to save time and money, and provide ancillary benefits like nut crops or pollard hay, there are also reasons to use “dead posts.” If your wooded homestead is short on land but long on wood, you may want to maximize your space by using every available inch of your property. Admittedly, using living fenceposts often means accepting Mother Nature’s haphazard arrangement of trees, which may significantly reduce available space. To contend with this, you may opt to construct your entire fenceline out of dead posts of a rot-resistant species, or you may opt for a hybrid system that uses a combination of dead and living posts.

DEBUNKING MYTHS

A variety of myths surround nails, staples, and other fencing hardware, including the notion that a tree will lift your fence as it grows. First, let's just be clear about how trees (including living fenceposts) grow. Trees do not grow from the bottom up; instead, each year's vertical growth is added to the top of the preceding year's growth. This means that your fence will remain at the same level, not be lifted upward. Tree trunks and branches also grow in diameter year by year, so nails and other fencing hardware (and sometimes even the fence itself) will over time become encased in new cellular tissue.

Attaching hardware to a tree can pose several problems. Anytime you pierce the bark of a tree you're inviting insects and disease. Also, should a sawyer decide to turn your living fencepost into boards someday, the encased metal will damage the saw's blade.

Another myth surrounding fence hardware is that galvanized nails and staples will poison the tree. This isn't true. In fact, galvanized nails are coated with zinc, an element that's actually essential for tree growth. This might make it seem like galvanized hardware can be beneficial; on the contrary, when compared to untreated steel hardware, the galvanized coating appears to slightly inhibit the tree's ability to heal itself by walling off the wound (a process called compartmentalization).

CHOOSING WOOD FOR POSTS

If you decide to use dead posts, be sure to choose the most rot-resistant wood you can. There are species that will last just as long as treated posts but without the chemicals. At the top of the list are black locust and Osage orange, both of which easily last half a century, and in more arid climates have been known to last 100 years. Eastern red cedar seems to last well for about 30 years. In the West, redwood is the preferred species, though you'll want to make sure it was sustainably harvested. In the South, bald cypress is coveted for its rot resistance. When I questioned an old-timer about how long a bald cypress post would last, he responded, "Three years longer than stone." Other acceptable fencepost woods include tamarack, spruce, and white oak. Woods to avoid for fenceposts include pine, poplar, basswood, ash, and birch.

To Peel or Not to Peel

Considerable debate prevails over the peeling of fenceposts. For some species like black locust, the tight bark and thorns quickly remove any casual notion of peeling the bark. The one noted exception is cedar, which many old-timers insist will last longer if the bark is removed. The theory is that the spongy bark retains moisture, thereby encouraging decomposition. If you do opt for peeling cedar posts (the bark can be used for rope, chinking, or tinder), you'll want to cut and peel the logs in early spring, just as the sap is starting to flow. If you time this properly, you'll be able to peel long strips without the aid of a knife or drawshave.

BUILDING WITH STUMPS

Three hundred years of taming nature in the name of pastoral agrarianism has largely erased the fact that millions of stumps were pulled to create cropland in America. The process was slow but straightforward for early homesteaders. First, the house site was cleared, with the wood being used for home construction and eventually outbuildings. Like ripples in a pond, homesteads expanded outward, from kitchen gardens and chicken yards to pastures and eventually cropland. Grazing and browsing livestock on freshly cleared land was an efficient arrangement as new growth was controlled, and livestock happily grazed around stumps. After a couple of years, the best growing sites were converted from grazing areas to cropland by pulling the now partially rotted stumps. These stumps played an important role in segregating potentially damaging livestock from the newly created cropland. While stone walls were erected over time, with stones "growing" from the soil each spring, the early fences needed to be erected quickly and economically; stumps fit the bill.

THE GRUNT WORK OF STUMP REMOVAL

As you can imagine, much of the labor associated with building a stump fence is in the pulling and moving of the stumps. Although such an endeavor is the epitome of grunt work, you'll be gaining a fence and clearing land at the same time. Like the early homesteaders, you'll want to wait at least a couple of years before attempting to pull any but the smallest of stumps. While an ambitious homesteader may choose to extract a stump or two by hand, building entire fence systems with them is a proposition that requires some serious horsepower, literally.

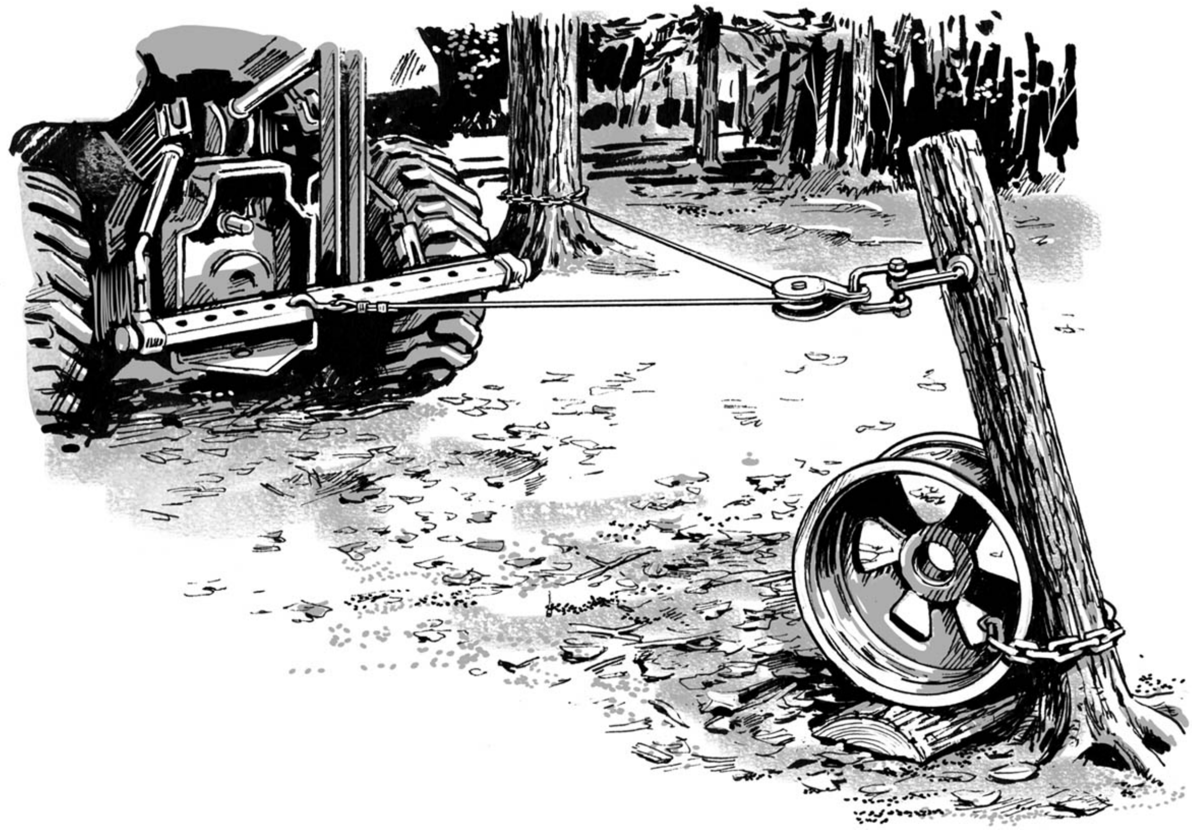
Pulling with Horses

Small stumps may be removed by a single draft horse, but it is easier, safer, and more efficient to use a team of horses. If you've left the stumps high, this will give you a leverage point from which to tip the stump. In this case, using a choker chain with a cinching slip hook is sufficient. However, if the stump is cut low, you'll want to use skidding tongs firmly planted into the side of the stump.

Make sure the horses' harnesses fit properly and are in good shape; harnesses and traces that break under the extreme stress of stump pulling pose a danger to you and your horses. If you are unfamiliar with fitting a harness, I recommend the book *Draft Horses and Mules: Harnessing Equine Power for Farm and Show* (see **Resources**). Also, make sure your horses are pulling at the proper angle of draft, and that when you give the command to "step out," there isn't excessive slack in the trace chains. You may discover that the stump loosens but doesn't pull from a single direction. In this case, reset your choker or skidding tongs and pull in the opposite direction.

Pulling with Tractors

If draft power isn't an option, using a small farm tractor may be just the ticket, especially if it's equipped with a front-end bucket, or loader. Pushing or pulling with the bucket offers several advantages over pulling with the drawbar. First, a hydraulically operated bucket allows you not only to push and pull stumps but also to lift and place the stumps for wall construction. Second, if your stumps have been cut high, you can use the edge of the bucket to push on each side of the stump to loosen it. Once you've managed to push the stump over, you can generally lift it with a choker chain attached to the bucket. Welding a flat-backed grab hook to the bucket will prove invaluable, not just for pulling stumps but for any other homestead project that requires lifting objects that don't fit neatly in the bucket. Once you've pulled the stump, jiggle the bucket to remove any loose soil, which is more valuable on your pasture than in your stump fence.



ABOVE: *An old truck rim makes for a perfect stump-pulling device. As the stump begins to loosen, it rotates over the top of the rim, popping it out of the ground. Whenever possible, leave tall stumps to create greater leverage for pulling.*

BUILDING A STUMP FENCE

Laying up stumps is similar to laying stones: overlapping courses form the wall. Begin by laying a row of stumps along your entire fenceline, rootballs down, as if they were still growing. If the final fence is to be taller than 4 feet, you'll need to build a double base in which two parallel rows of stumps are placed with a 1-foot-wide gap in the center to accommodate the next course of stumps. Place the stumps so that the rootballs point in toward the pasture and up toward the top of the fence. As the rootball dries out, the roots will become firm, pointy deterrents for livestock that might otherwise consider crawling on the new fence.

Aim for making the walls of the fence as vertical as possible while still retaining strength. Use the bucket of the tractor to pack down each course of stumps. Don’t worry if some soil still remains on the stumps; this will serve as “mortar,” binding the fence together. If you notice holes in your stump fence, don’t be afraid to fill them with smaller stumps or rocks. Most people are amazed by the number of stumps required to build a wall; however, if you find that you have too many stumps, consider either adding an additional course or building a stump shed (see below).

THE STUMP SHED

On a recent pasture development project, I found that I had a surplus of stumps but a lack of shelter for the livestock. For most livestock breeds, it is winter wind more than cold that leads to discomfort and increased feed consumption. Building a run-in for the livestock is the traditional solution to this problem, but for the woodland homestead, a more resourceful solution exists. The sheer mass of stumps makes them an ideal building material, one that is less prone to damage than conventional building materials are.

What I was looking to develop was a shelter that would allow five cows, a half-dozen sheep, and two draft horses protection from wind in one of my more exposed pastures. Additionally, I wanted the shed to serve as a feeding area to reduce winter exposure for these rugged-yet-not-invincible critters. One of the benefits of building with stumps over conventional methods is that you can build fences and structures in any shape you can dream up. In this particular case, I settled on a horseshoe shape that allowed the prevailing winds to pass around the curved structure. The walls are double stumps at the base and impenetrable to wind. The overall height is nearly 7 feet. I opted to leave the top open, but it could easily be covered by log purlins and either a metal or earthen roof.

At the center of the horseshoe-shaped shed, I feed 4' × 5' haylage bales to the livestock. The curved shape matches that of the upright bale so that the animals are able to easily circulate around the feed. Normally, I don't use a bale feeder; instead, each spring I take a pitchfork and clean out the stump shed. The mix of trampled hay and manure is simply tossed on the walls of the stump shed. In doing so, I've created the perfect environment for grasses and forbs to establish. As the stumps decompose, it will begin to look less like modern art and more like a grassy knoll or berm that eventually will become part of the pasture's functional, and edible, shed.

ABOVE: *Building a horseshoe-shaped stump shed is a great way to utilize old stumps and slash left behind after clearing a pasture. Orient the shed to block prevailing winds.*

SHELTERBELTS

In addition to using stumps as windbreaks, it's also possible to create shelterbelts from living trees. Shelterbelts are rows of trees planted strategically around farms and pastures to serve as natural obstructions to slow wind and protect soil from erosion. They can also be constructed around homes and buildings to reduce heating and cooling costs, and can provide important wildlife habitat as well as a variety of nontimber forest products.

Shelterbelts possess ecological and structural qualities that, in many ways, make them superior to built windbreaks such as snow fences and barrier walls. The strength of a tree, of course, lies in its ability to flex and bend. Crowns allow air to pass through without creating the turbulence generally associated with solid barriers.

Commonly, shelterbelts and intercropping (growing two or more crops in proximity) are combined to form an alleycropping system in which a variety of row crops are planted adjacent to a row of trees. The trees provide a range of products from lumber to fruit, while the alleycropped plants enjoy the protection of the surrounding trees. Alley or row cropping systems are discussed in **chapter 6**. Another hybrid option is to use shelterbelt trees as living fenceposts or, in the case of hedges, as a windbreak. The use of shelterbelts on the homestead is not a new concept. In fact, in the mid-1400s, the

Scottish Parliament urged smallholders to plant belts of trees to protect crops. In the United States, in response to the Dust Bowl of the 1930s, nearly a quarter million acres of shelterbelts were planted across the Great Plains.

SHELTERBELT DESIGN TIPS

The design and purpose of your shelterbelt allows for plenty of creative license, though it's worth adhering to a few basic principles:

- Shelterbelts should be oriented perpendicular to prevailing winds to maximize protection.
- If your shelterbelt doubles as a living fence, make sure gates and access points are included in your design.
- The ideal shelterbelt is one or two rows deep and composed of long-lived native species.
- Since shelterbelts are usually located in stressful environments, be sure to select hardy growing stock. Full crowns (40 to 60 percent of overall tree height) indicate productivity and better serve the shelterbelt function.
- If your shelterbelt is intended to double as a snowbelt to discourage snow drifts in winter, consider using conifer species.

THE CORDWOOD WINDBREAK

Cordwood windbreaks represent an effective, temporary barrier for windy garden sites. By constructing a cordwood windbreak perpendicular to the prevailing winds, you can allow young plants to establish themselves under a less stressful environment. What's more, if you build a cordwood windbreak in a sunny but windy area, such as your garden plot, your firewood will dry faster, which will cause it to yield more BTUs in less time.

Once the gardening season is done, consider moving your cordwood windbreak from the garden to the porch or side of your house. Not only will it be closer to your woodstove but it will also save energy by cutting down on drafts. Other winter windbreaks include hay bales stacked around the foundation and grain sacks packed with leaves.

SHELTERING IN THE WOODS

Growing up, I helped out a neighbor who raised beef cattle. Over his 150-acre spread, there was a 2-acre hemlock stand that the farmer considered sacrosanct. This dense patch of woods was reserved for shelter, and the cattle knew it. The old farmer referred to the patch as the "living manger," a spot where the cows could bed down under the comfort and protection of the hemlock boughs.

Remembering this simple yet ingenious solution, when the time came I made sure that my own homestead incorporated a similar sheltering spot. The protection offered by a living barn is a result of crown density. In my case, having all conifers means that the floor of the living barn is often snow-free, even when the surrounding silvopasture is under several feet of snow. While this tight canopy means good protection for livestock, not enough light penetrates the living barn to allow for grass or forbs to grow, a trade-off I willingly make. This density and the protection it provides, along with the absence of ground-level forage, are what differentiate the living barn from the surrounding silvopasture. Since the stump shed is primarily used as summer housing, the living barn becomes the winter abode for my livestock, which is important since year-round use of the living barn would lead to soil compaction and eventually tree mortality.

THE LIVING BARN

When fellow homesteaders ask for advice on building pastures for their woodland homestead, I always start by asking the same question: “Where are you going to put your living barn?” The response is often a quizzical look, which invariably leads to my well-rehearsed sermon on the virtues of sheltering animals among the trees. A living barn is essentially a wooded area that shelters livestock during rough weather. But it offers much more: it’s a barn that doesn’t require a hammer to build, offers good air circulation on the stillest of days, and doesn’t require a building permit to erect.

Deciding to integrate living fences and living barns as part of your homestead infrastructure represents a cooperative instead of a dominant relationship with nature. From a purely practical standpoint, it’s a low-cost and efficient way to address what are usually two of the most expensive items on the homestead.

LIVING BARN AND PATHWAY MANAGEMENT

Although you don’t have to paint or fix hinges on a living barn, it isn’t entirely maintenance-free. As with a “real” barn, it’s important to control where your livestock go, or don’t go, in the living barn. Without pathway management, you’ll quickly discover that your livestock will move around haphazardly, knocking down smaller trees and creating unwanted gaps or openings. One way to address this is to allow your livestock into the living barn for just a couple of days, noting the paths they choose most often. Your animals will want an escape route on all sides, but you'll notice that there's usually one area that they naturally gravitate toward. Once they've been given the opportunity to carve out a couple of paths, make the paths more obvious by clearing any obstructing debris.

In laying out the living barn's "alley network," or pathways you want to encourage your livestock to use, make sure you do your best to preserve the core as a protected bedding area. This is particularly important if you have a small living barn that offers few bedding locations. Generally, it's a good idea to feed outside the living barn. Leftover hay and bedding can become compacted and smother tree roots. One way to encourage the use of established alleyways is to place hay feeders near the entry and exit points.

ABOVE: *The living barn offers protection from both wind and sun. Control entry points and create additional protection by piling brush around the perimeter of your living barn.*

Living barns can also be modified to offer greater livestock protection and to encourage the use of prescribed entry and exit routes. One approach is to build stump fences between the entry and exit points. This creates a windbreak while at the same time controlling livestock movement. An alternative to building a stump fence is to simply pile brush in areas where you're looking to discourage livestock passage. Dead and thorny brush barriers are preferable to green brush, which could serve as attractive browse.

Conifers offer year-round protection as part of living barn arrangements. If the lower boughs of these trees prevent your livestock from bedding down or passing through the living barn, you may want to conduct a crown raising, in which the lower boughs are pruned, thereby allowing livestock to walk and bed down beneath. If your livestock includes aggressive browsers such as goats, chances are this work will be done for you.

Living barns can also be constructed out of deciduous species, though the benefits are mostly in the form of summer cooling as opposed to winter protection. The dense shade cast by trees in summer often translates into temperatures that are 8 to 10°F cooler than the surrounding pasture. Conifer-protected living barns offer warmer winter temperatures, customarily 6 to 8°F warmer than outside the living barn.

MAINTAINING THE HEALTH OF YOUR LIVING BARN

Given that living barns see intensive use, make sure your barn is part of a rotational system so that the trees, and the soil beneath, are given the opportunity to recover. This is especially important if your living barn is used when the ground is soft or wet. Also make sure the trees within the living barn stay healthy and continue to support large crowns. If you notice that choice trees are beginning to show signs of stress (first observed through off-color or sparse foliage), consider protecting them and their surrounding root zones with fencing, or better yet, move the livestock to another area.

Finally, realize that your living barn will need maintenance, in the form of periodic tending and selective thinning.

As you begin planning fencing and shelter systems on your homestead, I'd encourage you to think about ways in which systems can be designed to achieve multiple goals. In other words, can your living fence also be a crop source? Can you make your stump removal project into a homestead construction project? Cultivating this sort of resourcefulness will turn linear systems into circular systems and move you closer to self-sufficiency.

CHAPTER 6

Giving Trees

Fruit, Honey, and Syrup

The family orchard was once a staple of virtually all homesteads. Like most other features of the woodland homestead, these orchards were planted to serve a variety of purposes: the good fruit was eaten or made into cider, and the wormy drops provided animal fodder. In this chapter we'll consider the options for developing your own homestead orchard, whether it consists of 3 trees or 300. And if you're lucky enough to discover old fruit trees on your property, we'll discuss methods for resurrecting these forgotten, but certainly not fruitless, relics. We'll also take a look at opportunities for the integration of other crops like honey and maple syrup. But first, let's spend a little time understanding the anatomy of an orchard.

THE HOMESTEAD ORCHARD

An orchard need not be an endless expanse of large trees in perfect, long rows. Orchards, and the trees that make them up, come in a variety of shapes and sizes to match the land and the needs of the homestead. As with a garden, establishing an orchard requires you as head homesteader to match both the soil and the species (or variety) in a way that offers the greatest opportunity for success.

THE SITE

If we could design the ideal orchard site, it would be a gently sloping hillside protected by forest edge with well-drained loamy soil and a pH in the neighborhood of 6.5. You may, of course, find that your homestead is on a site that falls short of that ideal. (My unimproved soil, for example, is much sandier and has a pH about 2 points lower than the ideal 6.5.) However, don’t despair: fruit trees and orchards can be found from Sonora to Siberia. It’s just a matter of taking advantage of your homestead’s strengths and avoiding microclimates that are truly unsuitable.

Hardiness

By consulting a map of hardiness or growing zones, you’ll get a good idea of what is or isn’t possible in your general area. However, a given tree’s geographic knowledge extends only as far as its roots; in other words, your particular site may be more or less suitable than what the map suggests. Once you’ve identified the fruit trees that could theoretically grow in your area, based on their hardiness rating, take a closer look at the microclimate where you’d like to plant your trees.

Wind

You’ll want to begin your site evaluation by examining prevailing winds and opportunities to reduce extreme wind. A living fence, for example, offers an effective means of buffering wind without creating destructive downdrafts generally associated with solid windbreaks. Conifers are often used effectively as shelterbelts to protect vulnerable buds from cold winter winds.

Elevation

Elevation is likely to be the microclimate variable over which you have the most control when establishing a new homestead orchard. Low-elevation sites, particularly those that are in bowl or kettle landforms, are more likely to experience frost than high-elevation sites and should therefore be avoided. Hillsides are generally preferable. If you can't avoid a frosty site, consider selecting varieties that flower later.

Soil

While **chapter 1** offers a more in-depth discussion of soil properties, it is worth examining several soil characteristics that are of particular importance on the homestead orchard.

Drainage. Root health is largely a function of well-drained soils that are able to carry and deliver water and nutrients but don't leave the roots waterlogged. Clay soils retain moisture, which is great for helping trees through dry spells but can result in waterlogged roots. Even if the saturated roots don't kill the tree directly, they may stress it, allowing fungal diseases such as phytophthora root rot to establish, which can lead to mortality. If a well-drained site doesn't exist, planting on mounds may be an option. You may also choose to select fruit trees that can handle wet feet better, such as quince and pear.

Biodiversity. Until the mid-1800s, it was largely assumed that soil was nonliving and primarily served as a substrate to keep trees upright and anchored. It was early European foresters who eventually noticed the effects of compaction, erosion, and other factors that have profound effects on tree health, which eventually led to a more biological view of soils. Today, foresters and farmers alike are well acquainted with the idea of a “soil food web.” Thanks to photosynthesis and a powerful vascular pumping system, the soil food web cycles nutrients from deep within the soil. Aiding plants in their search for food are fungi and bacteria that naturally cycle nutrients through both biological action and physical movement.

Perhaps the most amazing members of the soil food web are mycorrhizal fungi. These root-colonizing fungi are microscopic but can increase by 100 times the roots’ ability to acquire nutrients in the soil. They also increase the absorptive capacity of the rhizosphere (the zone surrounding the roots, where important nutrient exchanges occur) 10-fold. If you were to examine mycorrhizal fungi under the microscope, you’d see long, threadlike hairs (hyphae) that serve as a network of connecting roots that transfer macro- and micronutrients, increase surface area, and protect roots from parasitic fungi.

Mycorrhizal fungi can even improve the physical structure of soils; when hyphae grow between clay platelets, for example, they help form larger aggregates. A healthy mycorrhizal community can be enhanced through soil amendments or root dips, which are a mycorrhizal inoculant that can be applied to roots during transplanting, or worked into the seedbed. However, one of the easiest and most important means of promoting healthy soil, including a large community of mycorrhizal fungi, is to avoid site compaction from both livestock and machinery.

Soil, Mulch, and Amendments

While volumes have been written about both mulching and soil amendments, there are several basic tenets that can help your trees to not only survive but thrive. If you're establishing a new orchard, you'll have the option of improving either the immediate rhizosphere or the soil over your entire orchard area. Given a choice, improving the entire area is preferable since the roots of your trees will eventually extend well beyond the holes where they're planted. By beginning with a soil test (see **chapter 1**), you'll be able to see which nutrients your soil is lacking.

If you're able to amend the soil for your proposed orchard area prior to the establishment of trees, consider sowing a crop of "green manure" (a cover crop that is plowed under and incorporated into the soil) the year before planting your trees. Green manure plants have the ability to draw up nutrients from deep within the soil or, in the case of some cover crops, extract nitrogen from the air and "fix" it (that is, convert the nitrogen to a usable form) for your orchard trees. One of the benefits of integrating animals with your homestead orchard is that they provide valuable fertilizer that can be composted or, in the case of soiled animal bedding, applied directly to the base of the tree as mulch, delivering a slow dose of nutrients and improving water retention.

You're also likely have a supply of wood chips from other forest improvement activities. These wood chips can play an important role as mulch material for saprophytic fungi, which aid in decomposition, and also serve as a food source for mycorrhizal fungi.

The best wood chips for mulching plants are those made from small-diameter trees and branches.

DECIDING WHAT TO GROW

If you're beginning your orchard from scratch, you'll need to decide what type of fruit you'd like to grow. While apples are undoubtedly the most ubiquitous fruit trees, you may want to consider the apple's pome cousin, the pear, or stone fruits such as cherries or plums. (See **Choosing Pome or Stone**.) Apples are the most numerous fruits in terms of varieties, with 2,500 varieties grown in the United States and 7,500 grown worldwide. These varieties not only deliver different fruit qualities but also represent a wide range of growing conditions, from USDA Zones 2 to 9. Other fruits, like apricots, struggle to grow below Zone 4. The table on the opposite page outlines common apple varieties as well as their uses and attributes.

SELECTING FOR SIZE

Your selection of fruit trees isn't limited to just species and variety; you'll also want to select your trees based on size, which is determined by the rootstock. In addition to space, other considerations linked to rootstock are preferred soil type, hardiness, disease susceptibility, and anchorage. Rootstock is generally categorized as standard, semidwarf, or dwarf.

Referencing rootstock can look a bit like alphabet-and-number soup, with initials indicating the research station where the stock was developed. The most common rootstock categories, from standard to dwarf, are: MM.111; MM.106; M.7; M.26; M.9; Mark; and M.27.

Nurseries match rootstock with a scion (a live shoot cut from your desired variety) through grafting. Sometimes you'll have a choice of various rootstocks for your desired species; other times the grower has determined that a particular rootstock is best suited to that scion, so you may not have a choice. The size of the tree is an important consideration in the context of the size and arrangement of your homestead orchard. Those with ample land often opt for large standard-size trees, which offer the benefits of shade and higher crowns but often require harvesting apples from ladder height come maturity. Considering these factors *before* you plant is the key to developing your dream orchard.

Make Your Own Bonemeal

In 1871, Sereno Edwards Todd, author of the seminal orchard manual *The Apple Culturist*, declared, “There is no more valuable fertilizer for apple trees on most soils than bones.” Indeed, bones are among the most soluble form of organic phosphorus, essential for root development.

I believe that anything that provides only one use on the homestead is second class; bones are no exception. After using them as soup stock, you can turn them into bonemeal fertilizer. Use a heavy-duty blender to pulverize small bones, such as chicken and rabbit bones. For larger bones, make sure they’re thoroughly dried and place them in an old pillowcase or grain sack. Tie the sack shut and place it on a wooden splitting block, then use a hammer or mallet to pulverize them. Be creative in your methods: hand-crank clothes dryers, car jacks, and cars driving over sandwiched bones (along with the traditional mortar and pestle) will all get the job done.

The finer the grains, the more soluble the phosphorus. When the Amish make bonemeal, they pulverize the bones according to the site on which the fertilizer will be used. For acid soils, they opt for coarse-ground bones, since the low pH environment will continue to break down the calcium-rich bonemeal. Sweeter or more alkaline soils use a finer bonemeal.

APPLES FOR EVERY REGION

Apple Variety	Attributes/Uses	USDA Zones
Aunt Rachel	Naturally disease-resistant, fast-growing tree; equally good for eating or cooking, the fruit is firm, mildly tart, and juicy	6–10
Bramley	The national cooking apple of England; has been successfully grown in both temperate and tropical climates; known for its intense flavor	5–10
Cortland	Great as a dessert and processing apple; copious producer	4–8
Dixie Red Delight	Developed in Alabama, this apple is known for its spicy flavor; keeps well	7–10
Duchess of Oldenburg	Old Russian variety that is extremely hardy and a favorite to those with a tart-loving palate; easy to grow	3–6
Honeycrisp	Keeps well; among the hardiest of apple trees, showing little damage at –40°F; characterized by a remarkably crisp and juicy texture	3–6
King David	A yellow-fleshed apple with a unique wine flavor; reported to be naturally resistant to insects	6–9
Liberty	Great for eating fresh, canning, and desserts; highly resistant to apple scab, and resistant to cedar apple rust and fire blight, making it a good choice for organic growers	3–6
McIntosh	Produces early with a good crop; versatile apple that makes a pleasant, tart cider	3–7
Northern Spy	Also known as Northern Pie Apple; a hardy, late-season apple that keeps in the root cellar particularly well; sought by cidermakers	4–8
Pink Lady	A copious producer that is winner of many apple tastings; one criticism is that it's rather susceptible to fire blight, so check with local growers before selecting this variety	5–8
Pristine	Medium to large fruit with canary-yellow color; somewhat tart, excellent for cooking or fresh eating; immune to apple scab, highly resistant to powdery mildew, and resistant to cedar apple rust	5–8
Reverend Morgan	A great all-around, late-season apple that's well adapted to hot climates	7–10

THE MULTIPURPOSE FOREST MICRO-ORCHARD

As you walk your homestead woodlot, you'll likely find areas where mature trees have fallen, leaving behind large, sunny gaps. In addition to fallen tree sites, these gaps also occur on old log landings and long-forgotten pastures. Assuming acceptable site conditions (drainage, slope, access), these forest openings can be ideal locations for establishing your own multipurpose forest micro-orchard.

With a bit of careful planning, you'll be able to integrate several homestead objectives in the same area. In other words, you can grow apples beside firewood, and firewood beside animal fodder and fenceposts. The ultimate success of this multipurpose model, however, is based on understanding a few key agroecological concepts.

Choosing Pome or Stone

Orchard trees are classified as either pomes or stones. Pomes include fleshy fruits like apples and pears and have a central core with five seed capsules, each containing up to 10 seeds. Stone fruits include cherries, apricots, peaches, nectarines, and plums. The common characteristic of these is a single, central pit or stone.

MANAGING GAP SIZE FOR SUNLIGHT

The gap must be large enough to allow light to reach your orchard trees, as well as any shade-intolerant and mid-tolerant plants you're growing alongside your fruit trees. Natural forest succession will attempt to reclaim the site as soon as a gap is created. This means you'll need to maintain the gap by removing trees at the periphery to allow sufficient light.

Depending on the size of the surrounding trees, you may be able to maintain sufficient light levels through judicious pruning. Region, aspect (the direction a slope faces), surrounding tree cover (conifer or deciduous), and successional stage (pioneer or climax) will all determine the minimum gap size needed to meet the solar requirements of your micro-orchard. However, as a general rule, 1½ to 2 times the height of surrounding trees is generally sufficient.

MANAGING COMPETITION

You'll also need to "weed" any undesirable trees that attempt to establish in your proposed micro-orchard. If you provide adequate protection for orchard trees using a sturdy fence, you may be able to control competition through grazing. Other options include mowing with a scythe or a brush hog. As you remove larger debris (logs, saplings, even rocks), consider using them to construct a crude fence around your orchard.

In addition to competing plants, you'll also have to deal with competing wildlife. Although establishing an orchard within a forest setting offers a variety of benefits, it also carries the challenge of keeping wild animals from snacking on your crop trees. Fencing to protect both the base of the tree (young bark is a nutrient-dense snack for voles and rabbits) and the top is essential until your orchard is fully established.

CONSIDERING SOIL

When establishing a forest micro-orchard, you have fewer options for amending the soil, since plowing and disking among trees and stumps isn't practical in a forest setting. The surrounding trees, along with the humus layer in your forest micro-orchard, will tell you a lot about your soil. A dense mat of needles surrounded by conifers is a good indication that the site has a low pH that isn't ideal for fruit trees. If you allow the surrounding conifers to encroach, they will continue to perpetuate poor, acidic soil. Your options are either to remove these surrounding trees and amend the soil throughout the orchard or to aggressively apply lime, potash, or other pH boosters within the root zone of your orchard trees. If you choose the latter, realize that amending the soil repeatedly is necessary. Trees need a consistent supply of nutrients for healthy growth.

If, in contrast, your surrounding forest is made up of trees, such as sugar maple, that demand highly fertile, alkaline soils, you’ll likely be able to establish your orchard without soil amendment. In fact, the surrounding leaf litter blowing into your orchard, along with the carbon inputs from decaying wood, will help promote a healthy forest micro-orchard.

ABOVE: *To produce lots of fruit, orchard trees need ample sunlight. The success of a forest micro-orchard is often dependent on maintaining sufficient gap size over time.*

MATCHING HEIGHT AND LIGHT

The physical structure of your micro-orchard is an important consideration to ensure that light is being used at different levels within the canopy. If, for example, your surrounding forest is made up of tall trees with high crowns, you'd want to select smaller orchard trees that are able to capture and use diffused light in the midstory and understory. Another challenge of tall surrounding trees is that they cast longer shadows, thereby shading your fruit trees. One way to address the issue of shade is to create a structural transition zone where trees are thinned so that those bordering your forest micro-orchard are smallest, gradually increasing in size as you move from the orchard center.

COMPLEMENTARY CROPS

The best complementary crops in a forest micro-orchard are those that can be produced without competing with orchard trees for sunlight or nutrient availability.

Understory Forage

Developing understory forage is among the most compatible of uses. This can be either woody animal forage collected using the shredding techniques discussed in **chapter 4**, or grasses and forbs. If your orchard trees are properly protected, you may choose to allow your animals to do the labor of harvesting. In late fall, consider allowing your animals to sweep your orchard floor clean of windfall fruit. Not only is this free forage, but it's also a helpful way to control fruit-borne insects and diseases.

Coppiced Firewood

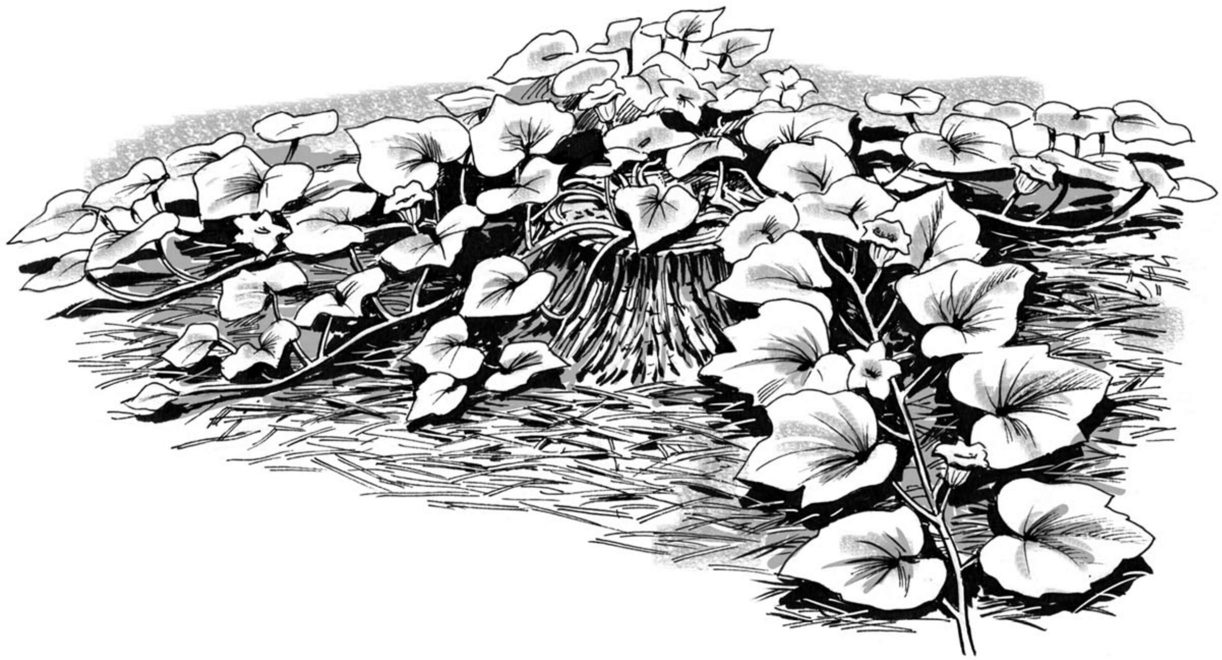
Coppiced firewood is another complementary crop in the forest micro-orchard. Growing trees for coppice wood works well in conjunction with cultivating taller, standard-size fruit trees. I generally harvest these coppice trees just as they reach the crown height of the neighboring fruit trees. Any “slash,” or remaining branches left after harvesting the coppice firewood, is cut up and left behind to decompose within the forest micro-orchard.

Sugar Maples

My favorite complementary crops to orchard trees are sugar maples, used for making maple syrup. If you’re fortunate enough to live in a region of the country where maples grow, they make great forest micro-orchard companions, whether dispersed throughout the orchard or planted in a row along the fenceline. While maples are known for casting deep shade, you can thin them strategically so that both your orchard and maple trees have sufficient light. One benefit of combining orchard and sugarbush is that management activities like pruning can be carried out simultaneously. The open structure of the hybrid orchard-sugarbush also provides access for harvesting both fruit and sap.

Row Crops

If your forest micro-orchard is laid out in rows, you may want to consider using the Swiss sandwich method, in which low row crops such as beans, potatoes, or oats are grown between orchard rows. In Switzerland the width of the rows between trees was originally based on the width of the horse-drawn cultivators and seeders that were pulled between the rows. Grasses, flowers, and forbs are allowed to grow in a 3- to 5-foot swath on each side of the tree with the row crops occupying the sunny, center alley. Animals were then allowed to graze and to glean drops after the row crops and fruit had been harvested in late fall.



ABOVE: *The stumps left from clearing around crop trees can be used as squash-growing containers. Construct a mound of rich humus over the stump, and insert your seeds.*

THE ECOTONE ORCHARD

"Ecotones" are areas of transition between two distinct ecosystems. Examples include the area between the barnyard and garden, and the intersection of pasture, fence, and forest. Often, these are some of the most underused areas of the woodland homestead. Ecotone orchards make the most of these areas by taking advantage of growing space that might not ordinarily be used. As in any orchard arrangement, you'll want to consider space. In some cases an ecotone orchard may double as a shelterbelt or even a living fence.

The most common ecotone orchard arrangements are located along pasture edges. If sufficient space is available, you may want to opt for standard-size fruit trees, which are able to handle this environmentally competitive zone. For these larger trees, 25-foot spacing is ideal. When you first plant these trees, the distance between them will seem monumental, especially if you're planting one-year-old whips. However, as the trees grow, you'll be glad you opted for the wide spacing since the crowns have a propensity to sprawl outward. For semidwarf trees, 18-foot spacing is ideal, and dwarf trees can be planted on 10- to 15-foot spacing, depending on specific rootstock.

The Edible Orchard Floor

Several indicator species of mycorrhizal fungi can be found on the orchard floor; these include puffballs, the famously fun fungi that kids love to explode, and morel mushrooms, which cooks and foragers adore. Also, organic orchards commonly have abundant morel mushroom populations that make for healthy soil and healthy meals!

LAYERING FOR ORCHARD AND GARDEN

The success of all the forest micro-orchards presented thus far will be based on capturing light and nutrients from different areas of the forest, thereby maximizing efficiency. Most often, your forest micro-orchard will have two or three layers, each representing a different crop, though it is possible to occupy virtually every level of the forest with careful planning and the right plant species. Forest gardening expert Robert Hart took this polyculture to an extreme by carefully selecting species that are adapted to increasing levels of shade in the understory. The result is a seven-layer orchard that's an edible forest landscape.

Hart intercropped edible polyculture landscape with the following layers (see illustration below):

A. A *groundcover layer* consisting of edible creeping plants that spread horizontally and inhibit weed growth. These plants can include strawberries, nasturtium, and wintergreen. In systems focused on animal forage production, consider planting clover.

B. A *rhizosphere* or *root layer,* which creates an underground site for planting garlic, onions, or potatoes. Shallow-rooted plants are preferred to minimize interference with other plants. If animal forage is your goal, consider planting Jerusalem artichokes, which are a favorite of pigs.

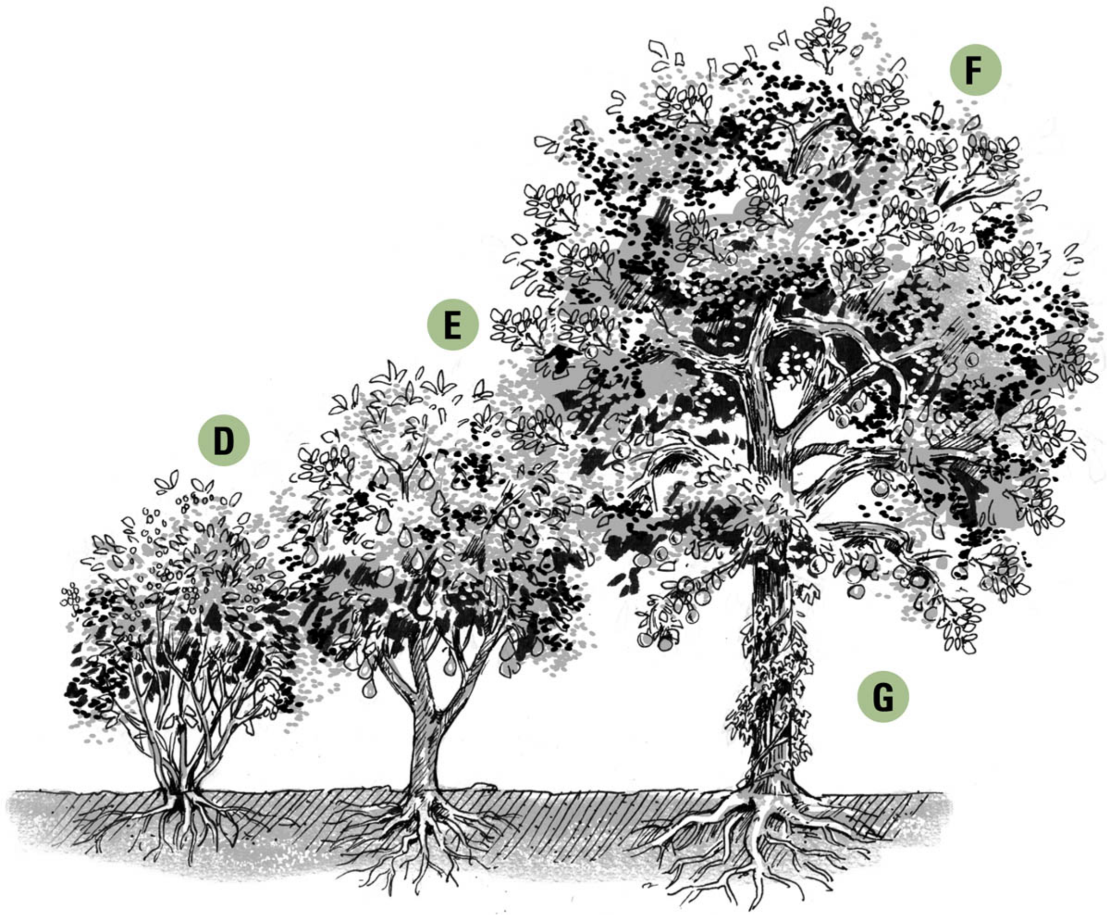
C. An *herbaceous layer* consisting of perennial vegetables and herbs. While this layer is generally assumed to be mostly nonwoody plants, there are some exceptions such as lowbush blueberry. Herbaceous plants that require more sun can be planted at the orchard edge or in any particularly sunny opening. Opt for perennials to minimize labor, and for native species that support healthy ecosystems beyond your homestead orchard.

D. A *shrub layer* consisting of fruit bushes such as currants and berries. Plants in this layer may be edibles, such as blueberries and hazelnuts, or species intentionally cultivated to attract pollinators, essential to your orchard's success.

E. A *low-tree layer* consisting mostly of smaller nut and fruit trees. Commonly, the same species of fruits or nuts grown in the canopy layer are grown here, just on dwarf or semidwarf rootstock. Many stone species such as apricots, peaches, and tart cherries do well in this growing zone. If fenceposts are on your shopping list, you may want to consider growing black locust in this space; its light, open canopy is a natural fit. While black locust can grow large, the assumption here is that you'd harvest pole-size trees.

F. A *tall tree or canopy layer* consisting of mature fruit trees, mostly apples and pears. At this level it's important to make sure the trees are widely spaced. Species with dense crowns are better suited to two- or three-level micro-orchards because of the shading effects. Walnut trees are also a good choice since they tend to grow tall with relatively open crowns.

G. *Vines and lianas,* which take advantage of space that is rarely used. They can be trained to climb existing trees or can be supported using poles or trellises. Options include grapes and hops as well as a variety of pollen-rich flowers. You may also want to consider cucumbers, melons, and even squash.



ABOVE: *Creating an edible forest landscape requires an understanding of relative shade tolerance among species, nutrient requirements, and interspecies ecological relationships.*

THE ART OF PLANTING

Foresters, horticulturalists, pomologists, and nurserymen all seem to offer different advice on the "proper" way to plant fruit trees. Opinions vary on the best time to plant, which soil amendments to use, and even how to water newly planted trees. The instructions I give here are based on the methods I've used to plant and transplant trees with a good track record of success, even under less-than-ideal site conditions.

WHAT SIZE TREE?

Whether planting trees as part of an ecotone orchard, a multipurpose forest micro-orchard, or simply as a single tree, you'll need to decide how mature a tree you're going to plant. For most folks this is as much an economic question as anything else. Those looking for an instant orchard can purchase mature fruit trees and plant them using a tractor-mounted planting spade that keeps the rootball intact. The cost for this can range from several hundred dollars to several thousand dollars, depending on size and location. However, for the cost of a single mature tree, you could purchase enough young bare-root trees to plant an entire orchard. It's for this reason that many people recommend establishing your orchard as the very first homestead project.

Most folks will be starting with much younger trees, and these are usually sold either bare-root or in containers. Bare-root trees are grown at nurseries and lifted from the soil during dormancy. These trees are usually only one or two years old, meaning that in most cases you'll be waiting four to six years to harvest your first fruits, depending on species/variety. Your second option is to buy containerized trees, which may be older and closer to fruit-bearing age but are also more expensive. In general, younger trees are easier to transplant and show a much higher survival rate after being planted, compared to larger specimens of the same variety. So it follows that smaller trees would generally show better survival rates. However, this depends upon the quality of the tree's root system. A dense, fibrous root system survives transplanting better than a less-branched, less-fibrous root system does. For this reason, some nurseries root-prune field-grown trees a year before transplanting, as a way to improve the odds of survival for larger trees.

> *"The best time to plant a tree was 20 years ago. The second best time is now."*
>
> — CHINESE PROVERB

PLANTING BARE-ROOT TREES

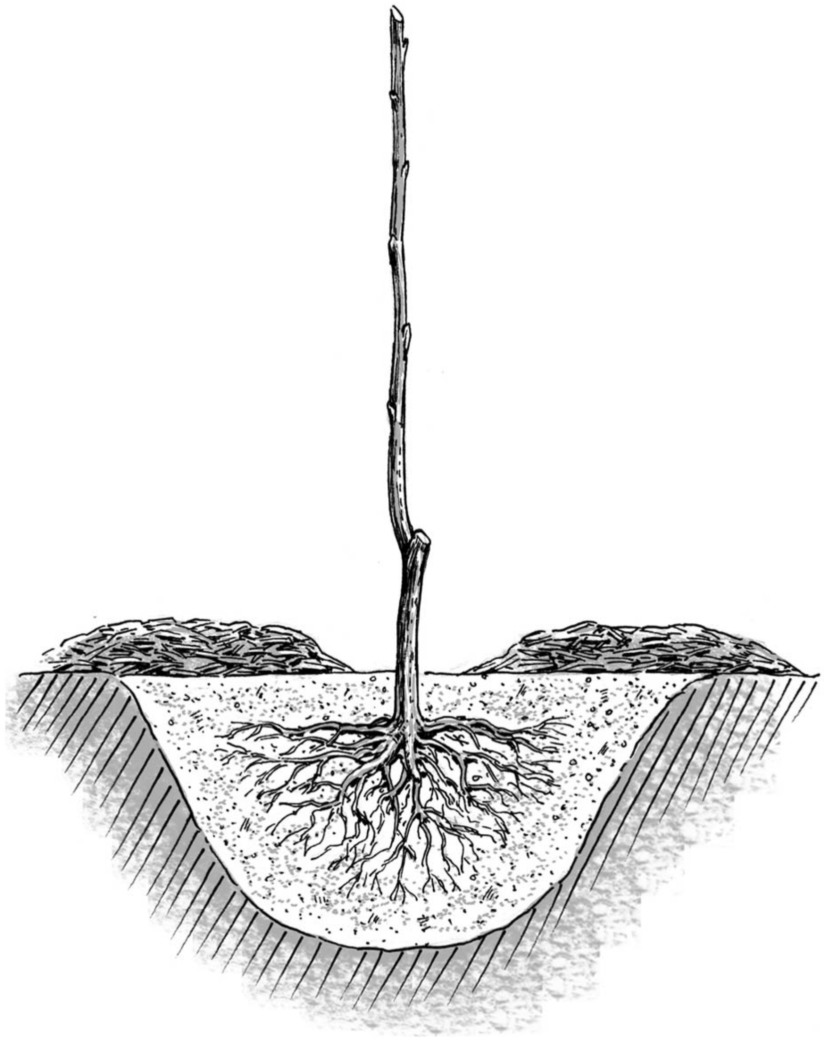
When new or aspiring homesteaders tell me about their dreams to "live off the land," I often tell them that the first thing they should do when they acquire property is plant fruit trees. It takes several years to establish a woodland orchard, and the most economical way to start one is by planting small, inexpensive bare-root trees. The most inexpensive of all bare-root trees are one-year-old "whips"— a young tree with no branches or lateral snoots. These are often sold at subsidized prices by state nurseries or soil and water conservation districts. Your other option is to purchase two- or three-year-old bare-root trees that are more established but also significantly more expensive than the whips.

Keep Roots Moist

If you've ordered your bare-root trees by mail, they'll arrive with the roots wrapped in wet newspaper or straw to keep them from drying out. If you're unable to plant your trees as soon as they arrive, that's okay; you'll just need to make sure that the roots remain moist. Ideally, it's best to plant on a damp, overcast day that's not too windy, since roots can dry out quickly during planting.

Dig a Large Hole

Begin by digging your hole. It should be approximately twice the width of the roots of your tree when the roots are spread side to side. The depth of the hole should extend a couple of inches below the root depth. If the size of the hole seems extravagant, consider that you're trying to create conditions that will allow your tree to not only survive today but also thrive tomorrow. As one homesteader put it, "Dig a 5-dollar hole for a 50-cent tree."



ABOVE: *Make sure your planting hole is wider and deeper than the tree's roots; this will allow for rapid, unencumbered root growth.*

Stake for Stability

To give your tree additional stability, consider staking. It's important that the stake is inserted into the hole *prior* to planting the tree. Inserting the stake after the tree has been planted may damage the roots. The stake should be pounded into the hole on the side from which prevailing winds blow. The tree should be staked at a 45-degree angle, and the stake should be placed well outside the root zone. An alternative staking method is the double-post approach that uses vertical stakes, each located well outside the immediate root zone. The tree is then connected to the stakes using sections of inner tube from an old tire.

To Amend or Not?

It was once thought that the hole should be amended with lots of fertilizer to give the tree extra nutrients. One problem with this approach is that the tree can suffer a nutrient deficiency once the nutrients are used up. Another line of thought argues that if all the nutrients are contained in the planting hole, the tree has little incentive to establish deep and wide anchoring roots, and instead never leaves the "comfort zone." A better way to address this question is in the context of your existing soils. If your soil has good texture (loam) and good structure (low compaction) and acceptable levels of organic matter, then it's not necessary to add any fertilizer or amendment. On the other hand, if you have poor or sandy soils (which don't retain nutrients very well) it may be worth adding a soil amendment such as organic compost. If you do this, be aware that added compost often results in the creation of a void as it settles. Avoid this issue by backfilling carefully and mix with the parent material that you removed from the planting hole.

Backfill Carefully

Take your time in backfilling the hole. Make sure that the roots are spread outward and downward, both to maximize nutrient uptake and to anchor the tree. Roots that curl up, known as J roots, almost always result in tree mortality since roots are intended to grow and draw nutrients upward. To avoid this, hold the tree with one hand as you backfill, making sure that the graft union is 3 to 4 inches above ground level. You can also make a slight mound at the bottom of the planting hole to encourage the roots to spread out.

As you add soil back to the hole, make sure that the roots of the tree remain horizontal; pretend you're making root sandwiches, with the lateral roots smoothly rolling off the sides of the taproot. With each successive layer, you can pat the soil down until the hole is filled. Once the hole has been filled, pack the soil around the base of the tree with your hands to work out the air pockets. Now that it's compacted, you'll notice a slight depression, which is okay. Water the tree slowly (10 gallons is usually sufficient); this will allow the soil to work its way down and fill in any air pockets. As a final step, dress the area around the base with a top layer of soil, making it level with the surrounding ground.

You may opt to mulch around the tree with ramial wood chips, soiled animal bedding, straw, or grass clippings, all of which will add nutrients as they decompose and prevent other plants from establishing and "stealing" nutrients from your fruit trees. It's also essential that the tree be watered immediately after planting and regularly for several weeks thereafter, depending on your climate. As a general rule, the larger the transplanted tree, the more water it will require, both in quantity and duration. A 4-inch DBH tree, for example, may require daily watering for a month, while a 2-inch sapling might only require daily watering for two weeks. Frequent watering is important, because it can discourage health issues such as slow establishment, canopy dieback, and bark splits.

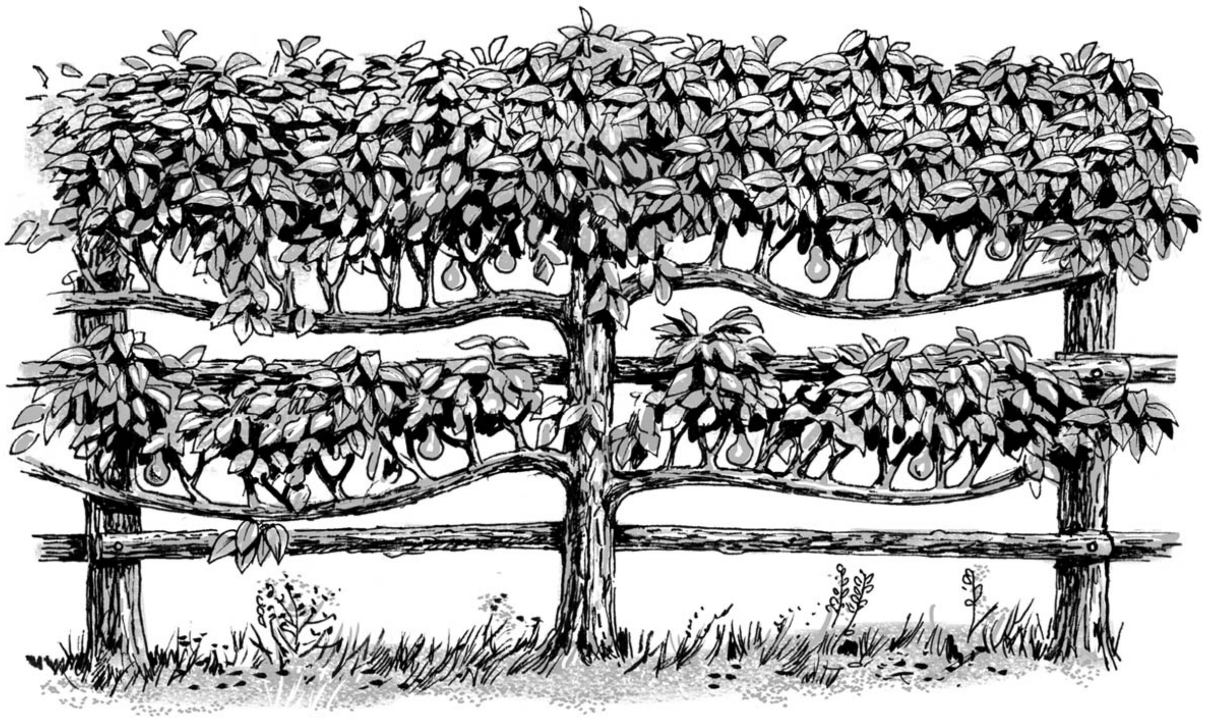
PLANTING CONTAINERIZED TREES

The process for planting containerized, or pot-grown, trees is essentially the same as for bare-rooted stock, with a couple of notable exceptions. Since the tree has become acclimated to the soil in the container, it's important to create a gradual transition to the new parent soil on the orchard site. By using your fingers to loosen any bound roots and soil, mix the surrounding soil in your planting hole. The more gradual this transition is from containerized potting soil to the site's soil, the better. As a general rule, the width of your hole should extend 18 inches beyond the containerized edge.

Once the tree is planted, staked, and mulched, it's easy to assume the work is done. However, in my experience, more immature fruit trees fall victim to improper protection from animals than to improper planting. Protecting trees need not be a daunting prospect. A simple rabbit or vole guard can be made out of hardware cloth and wire ties. The guard should not only wrap around the entire tree and extend to a height above the snowline, but also be pinned to the ground using a short metal stake to prevent rodents from burrowing underneath. If you live in an area with significant deer populations, or if you'll be grazing livestock near your young trees, consider building a secondary fence around the vole guard. Just make sure it’s tall enough and strong enough to withstand a curious animal’s penchant for young, fresh shoots!

TRELLIS-TRAINING YOUR ECOTONE ORCHARD

Perhaps your proposed ecotone orchard is along an old fenceline, but you don’t have much space to expand outward? If this is the case, consider employing an ancient orcharding method developed by the Romans and perfected by the French. Known as espalier (derived from the French word *épaule*, meaning shoulder), this artful method allows us to grow fruit trees in a two-dimensional area — perfect for the woodland homestead with limited space. By developing a lateral structure to the tree, you allow the fruit to receive full sunlight and stay at an easily harvestable height.



ABOVE: *Training fruit trees to grow in espaliered form takes advantage of existing fence lines and other underutilized spaces.*

Select Whips

Your espalier orchard begins by selecting quality whips on dwarf stock. Apples, plums, and pears are most suitable for espalier systems, though cherries can be trained to grow in a fan, serpentine, or tiered pattern. Importantly, the varieties you select need to be “spur-bearing,” meaning that their fruits form close to the branches, as opposed to at the tips of vertical shoots. Apple varieties best suited for espalier include Northern Spy, Golden Delicious, Liberty, Redcourt, and Holiday. Since most fruit trees aren’t self-pollinating, you’ll need at least two of them in order to produce fruit.

Establish a Structure

If you’re planting along an existing rail fence, you can either train your tree to use the existing rails or attach a series of horizontal training wires to serve as the lateral support system (at 12-inch intervals). It is important to establish this structure prior to planting your trees, to avoid damaging the roots. Trees should be planted 12 to 15 feet apart, using the method described **here**.

Make the Training Cut

Once the dormant tree is planted you’ll make your first training cut, a 45-degree angle just above the second wire, which should be 2 to 2 1⁄2 feet above the ground and just above a healthy bud. Attach the tree loosely with twist ties to the bottom and second wires. This completes the process until the growing season begins.

Train the Lateral Branches

Throughout the first growing season, train the lateral branches to grow along the wires or rails. When they reach the next post or neighboring espalier tree, head off the tips. As the lateral branches grow, so will the terminal leader, which will need to be pruned back periodically. You’ll want to prune it in such a way that you retain a pair of buds that can grow laterally on the next wire.

By the third year, your espalier system should be sufficiently established. At this point you’ll be able to focus your energy on pruning erratic growth and promoting fruit spurs. Vigorous trees may bear fruit in year three, but it may take as many as six years depending on individual tree vigor and microclimate. If your trees produce small or immature fruit, it may be due to low light conditions. To address this, you may need to remove taller, surrounding trees. Remember, as an orchardist, it's your job to manage competition for both light and growing space.

RESURRECTING THE WOODLAND ORCHARD

For me, homesteading is about the resurrection of knowledge, tools, and land. When I purchased my land, I asked if there were any fruit trees on the property. The real estate agent told me the land had been the site of an old homestead a century prior, and that all homesteads had a few apple trees, but that I shouldn't get too excited because they were probably dead by now, assuming I could even find them. While the agent was correct in guessing that the property had a few fruit trees, he was wrong about their health. Fruit trees, and particularly apples, are among the most resilient of trees, almost always capable of resurrection.

All of the apple trees I located on my homestead were growing in the understory of an overstocked mixed forest. Fruit trees respond to the extreme shade of such a situation by slowing their growth rate and ceasing fruit production. The trees are able to maintain this conservative existence for decades, waiting for you to appear one day with saw and shears.

The resurrection of old fruit trees comes with a bit of a caveat. When you stumble upon an old fruit tree in your woodlot, you won't know the tree's origin or variety, and the quantity and quality of fruit it will produce won't be apparent for several years. Still, if your goal is to make cider, sauce, or jam rather than to eat sweet, blemish-free apples straight from the tree, this isn't so much an issue.

CLEAR AROUND THE TREES

Restoring a woodland orchard, even if it's just a couple of trees, begins by clearing the area around your trees. Since the trees have likely been under shade for many years, I believe it's best to slowly introduce the tree to increasing levels of sunlight. In year one, I removed all trees taller than my fruit tree within a 20-foot radius. I expanded the area another 10 feet in years two and three, creating a 50-foot radial gap after three years. This three-year gap expansion coincides with the amount of time it takes to restore most abandoned fruit trees to productive, fruit-bearing condition.

When clearing the area around your fruit trees, remember that your goal is just to give your tree access to sunlight. This may mean that you'll be able to grow coppice fodder/firewood or other shorter "products" around your fruit tree without inhibiting growth.

Tools for Clearing

In addition to the tools and techniques for clearing discussed in **chapter 2**, you will need several specialized tools for efficient pruning. These include pruning shears, bypass loppers, and a pruning saw. As with most other tools, price point varies greatly. Investing in quality tools not only makes the work more enjoyable (pruning with sharp shears is akin to carving butter) but also makes for higher-quality work. Dull loppers, for example, can crush branches instead of slicing them, thereby injuring the tree. Quality tools also mean faster work, which leaves you more time to admire your orchard — glass of cider in hand, of course.

As a general rule, use pruning shears to cut branches up to the thickness of your pinkie finger, or about 5⁄8 inch. For live branches between 5⁄8 and 7⁄8 inch, use a sharp pair of bypass loppers, which work essentially like big scissors. For dead branches, you can use anvil loppers, which work like a knife and cutting board, or as I prefer, a handheld pruning saw. Handheld pruning saws can have either a fixed blade or a fold, the latter of which is handy when you're climbing on a ladder. With all of these tools, your goal should be to produce clean cuts that allow the tree to heal quickly.

TIPS FOR THE WOODLAND ORCHARD

Admittedly, pruning and caring for fruit trees can become a bit of an obsession. You'll find yourself studying the form of each branch, trying to encourage growth in some areas and discourage growth in other areas. The following tips and tricks can help.

Deciding How Much to Prune

A common question regarding pruning is, How much of the crown can I remove at one time? As a general rule, you can take out up to one-third of the crown when pruning or thinning. Attempting to remove any more than this in a single season will cause undue stress to the tree, and more water sprouts the following season. As for crown density, remember that your goal is to get light to all the branches so that fruit buds can bear fruit. The old adage is that you should be able to toss your hat through the crown of an adequately pruned fruit tree.

Training Branches

Branches that are too close together or that are growing at an upward angle instead of the ideal 70- to 90-degree outward angle can be trained by using branch weights. One simple way to make a branch weight is to superglue a fruit-size rock to a clothespin and hang it on branch that you'd like to train lower. A variation of this is to tie a string to a clothespin and stake the string in the ground with the appropriate tension to create the desired branch angle.

On young trees, you may discover that a desirable branch could benefit from a wider crotch as a means of producing a widely layered scaffold form. Old paint sticks or broken shakes work well for constructing crotch spreaders; just make sure that the notch in each end is appropriately sized and placed to prevent the spreader from coming out on a windy day. Other methods of training branches include tying a stone to a string and hanging it from the branch (stone size will dictate how low the branch hangs) and tying off branches to a protective cage (a “tree fortress”) below.

Restoring a Forgotten Fruit Tree

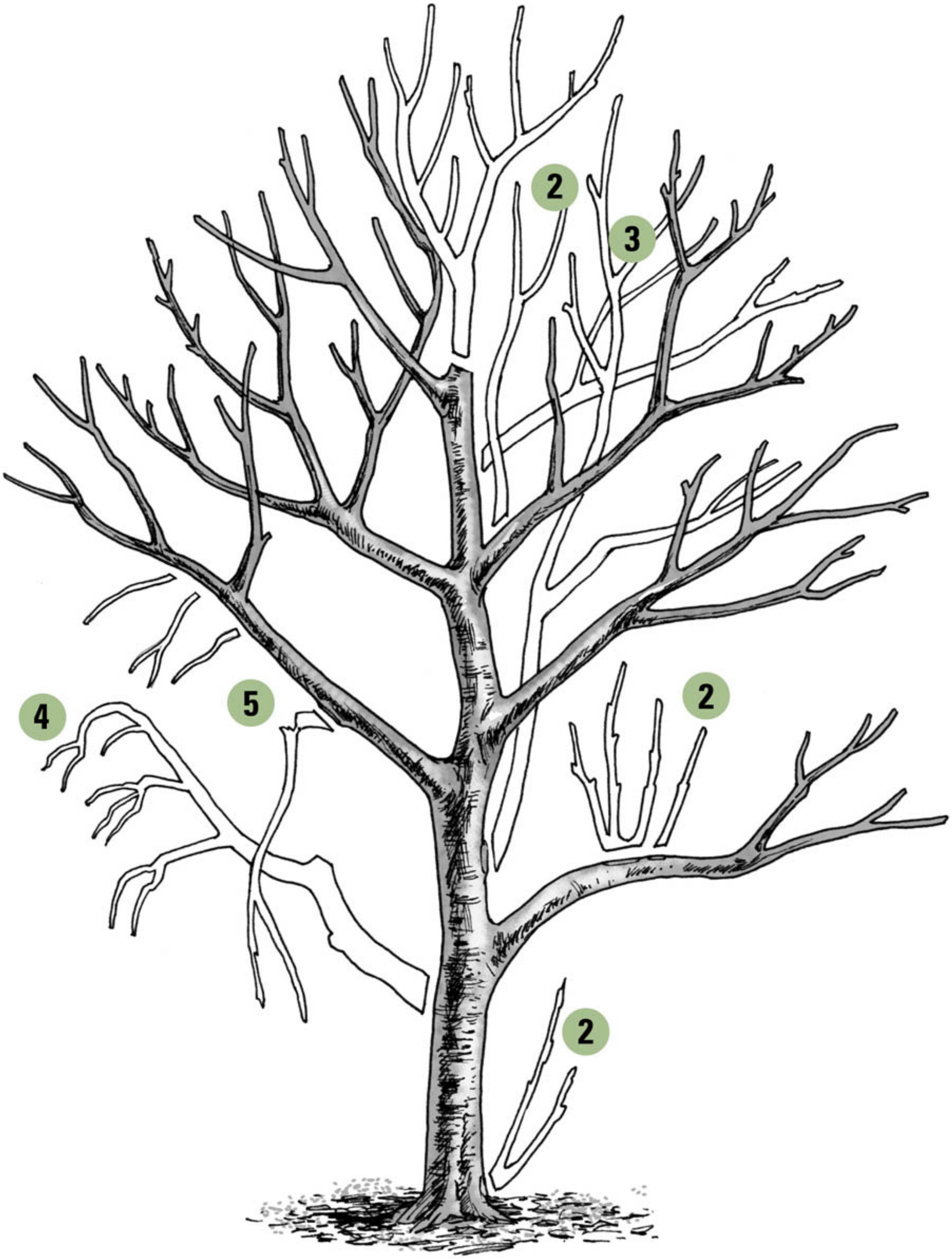
Once the tree has been given a growing season to adjust to increased light conditions, you can take the following steps to restore it.

Instructions

1. **Study the shape of the tree.** Before you pull out your loppers and saw, take some time to study the shape of the tree or, more specifically, the shape that the tree *could be,* given the benefit of time and judicious pruning. Strive for creating a central leader and a shape that resembles a pyramid.
2. **Remove water sprouts.** Begin by removing any vertical branches or water sprouts. Water sprouts are vigorous vertical shoots that redirect nutrients from the rest of the tree, thereby discouraging fruit formation. Water sprouts can be pruned in summer to encourage the tree to focus its energy on fruit buds. Old vertical wood should also be removed to encourage a central, single leader.
3. **Remove branches that cross.** Abrasions caused by rubbing are entry points for pests and disease. Additionally, remove any branches that double-back into the center of the tree.

4. **Remove lateral branches.** If you're intending to graze pigs or sheep in your woodland orchard to glean fallen fruit, consider pruning all lateral branches below 3 feet. This will help discourage climbing which can break branches and damage the bark. Repeat these steps over two to three years. Gradual pruning of trees that have been abandoned and forgotten is essential to preventing shock.

5. **Remove dead wood.** After the immediate area around the tree has been cleared, you should remove any dead wood from your fruit tree. Unlike removing live wood, this doesn't need to be done gradually; just make sure your cuts are clean and executed at the branch collar which will encourage callus tissue to develop, sealing over the wound. If you can, allow the tree a full growing season to adjust to the new light conditions and begin healing the wounds where dead wood was removed.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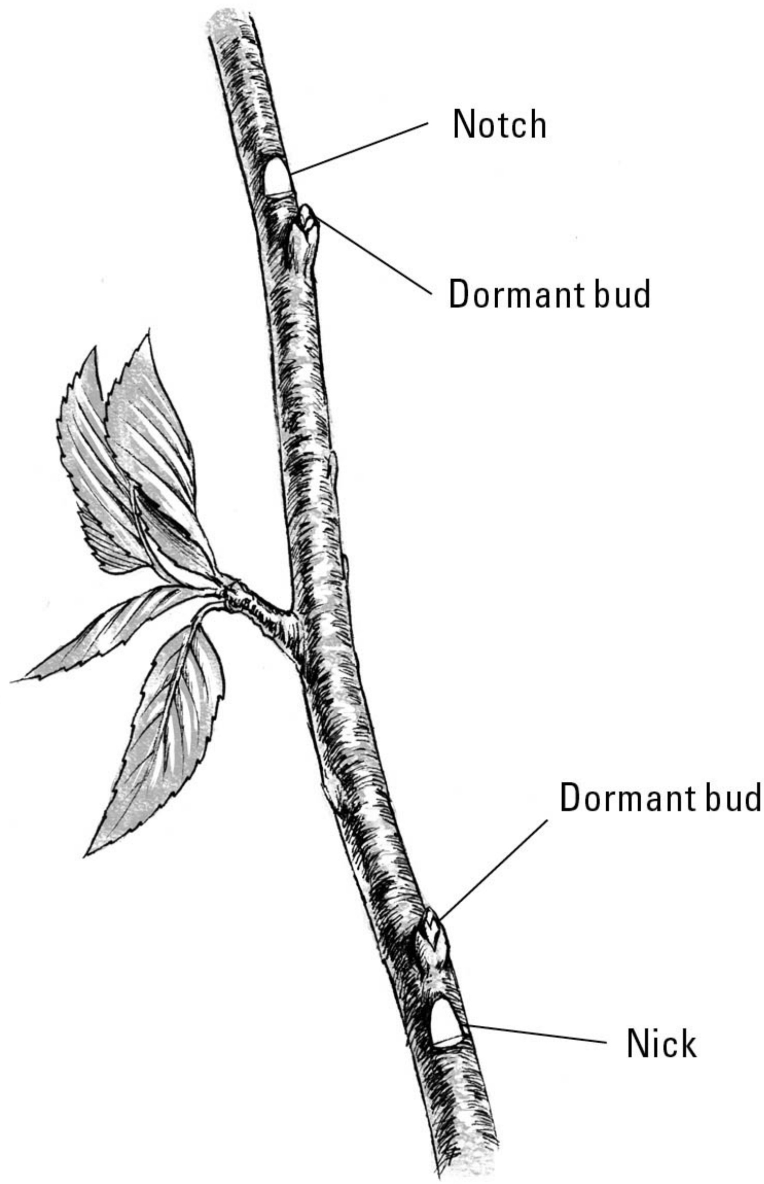
2

ABOVE: *This illustration shows which branches to prune based on the pruning guidelines. Note that on this tree the terminal fork was removed to encourage a lower crown, giving greater accessibility during the harvest.*

Notching and Nicking Branches

While pruning, you may also identify some buds that you want to encourage and others that you want to discourage. “Notching” is making a cut to a branch *above* a bud; this encourages the tree to send nutrients to the bud as a response to the injury. The result is the establishing of a vigorous new leader the following growing season. This method is particularly useful if you’re trying to encourage a bud in a specific location, such as with espaliers. Similar to notching is “nicking,” which is removing wood just *below* the bud to discourage growth. The result in this case is a “bleeding” of nutrients that weakens the bud. Both notching and nicking should be used only on apple and pear trees, since stone fruits are generally more susceptible to bacterial cankers from open wounds.

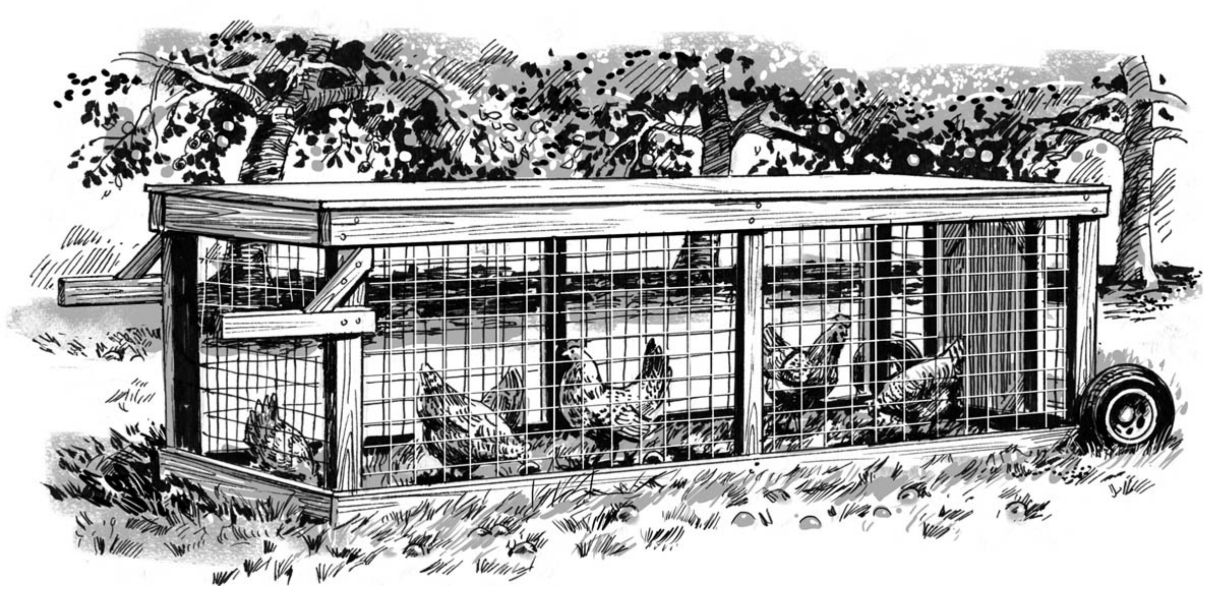
For both nicking and notching, use a sharp knife and extend the cut just past the cambium, which is the layer of active cell growth under the bark. Be sure to clean your knife with a dilute bleach solution between trees to prevent the spread of bacteria and fungi.



ABOVE: *Although not a common practice, notching and nicking are an effective means of discouraging and encouraging bud growth. Nicking discourages growth by preventing sap from reaching the bud; notching encourages a hormonal response that sends sap toward the bud you're trying to promote.*

MANAGING PESTS

Managing pests in a woodland orchard can be a challenge, but it can also be an opportunity. The shade provided by fruit trees makes your orchard an ideal location to practice mob-grazing chickens throughout the summer. Not only will you lower the pest count in your orchard, but you'll also be supplementing your chickens' diet while simultaneously fertilizing your orchard. A **chicken tractor**, or mobile coop, helps ensure even and concentrated grazing (see below).



ABOVE: *Using a chicken tractor to control orchard pests is an organic alternative to conventional pesticides. The tractor should be moved at least once per day, preferably twice.*

Physical Barriers

In terms of protecting your actual fruit, physical barriers are often a practical solution. While labor intensive, bagging individual fruits means you can avoid using chemical pesticides and still have a beautiful, blemish-free harvest. Among the predators you'll be stopping are apple maggots, stink bugs, and various moths; you'll also be able to reduce bird and squirrel damage.

Bags. You'll want to bag during the fruitlet stage, before pests have the opportunity to wreak havoc. Traditionally, cotton sacks (and later, paper bags) were used to protect fruit, but you can also use plastic sandwich-size bags with slider locks, though you'll need to punch a few holes in each bag or snip off the lower corners to allow the leaflets to transpire. Paper bags can be loosely tied on with strings, while plastic bags can be held in place with the slider locks. As you bag your fruitlets, use this as an opportunity to thin the crop, focusing on removing small or already blemished fruits.

Kaolin clay spray. Another option for protecting your fruit crop is to use a kaolin clay spray. This dilute clay mixture is a great way to deter pests such as the apple sawfly and plum curculio. Pests quickly discover that the clay clogs their pores; the inhospitable environment also makes it impossible for the insects to reproduce. Although early orchardists experimented with potters' clay, the clay particles were too large to stick to pest orifices and thus did not clog them. Commercially available clays have been sifted through an extra-fine filter to ensure effectiveness. Finally, realize that a single application of kaolin spray is insufficient. Most clay products will require three applications, since you'll want to target pests at various life stages.

Tree fortresses. If your orchard experiences significant deer pressure, consider building individual tree fortresses. These fortresses can be made from pole-size wood that's left over from thinning your orchard. To build the tree fortress, alternate stacking logs (as if you're building a log cabin), and screw each course of logs together to add stability. The fortress should be high enough that deer can't reach over the top to browse. You may want to add a secondary fence of monofilament fishing line at the top of the fortress to deter deer. Fishing line is surprisingly effective as a secondary psychological barrier: the deer feel the pressure of the line but can't see it.

BEES IN THE WOODLAND HOMESTEAD

You may have noticed that behind the myriad practices discussed in this book is a philosophy that no plant, animal, or plot of land serves a *single* purpose. Instead, the focus is on creating synergistic systems in which multiple benefits stem from a single component. Perhaps nowhere is this so clearly exemplified as in the case of homestead beekeeping. Honeybees (*Apis mellifera*) are the ultimate multipurpose producers, a friend to the forest, orchard, garden, and homesteader. In fact, bees are responsible for pollinating about one-third of our food supply, ranging from apples to watermelon and beans.

Unfortunately, our venerable homestead companion has in recent years fallen prey to a phenomenon known as colony collapse disorder (CCD). While experts debate the exact causes of CCD, it's likely that several compounding factors have contributed to the decline. These factors include loss of forage plants, insecticide use, and an influx of the varroa mite. By establishing your own homestead hive, you'll not only be doing your part to help keep honeybees alive, you'll also be rewarded with increased fruit and vegetable production, beeswax, propolis (used by the Greeks to treat burns and wounds), and, of course, honey.

Which Bee Does What?

A successful hive is dependent on a queen, drones, and worker bees. The job of the queen is to grow the colony by laying eggs, often as many as 2,500 per day. The small worker bees (all females) are the marathon athletes of the hive, visiting 50 to 100 flowers on each trip and only living about six weeks. Larger than the worker bees are the drones, who don't have a stinger and don't produce honey but do tend to the hive and mate.

GETTING STARTED WITH BEEKEEPING

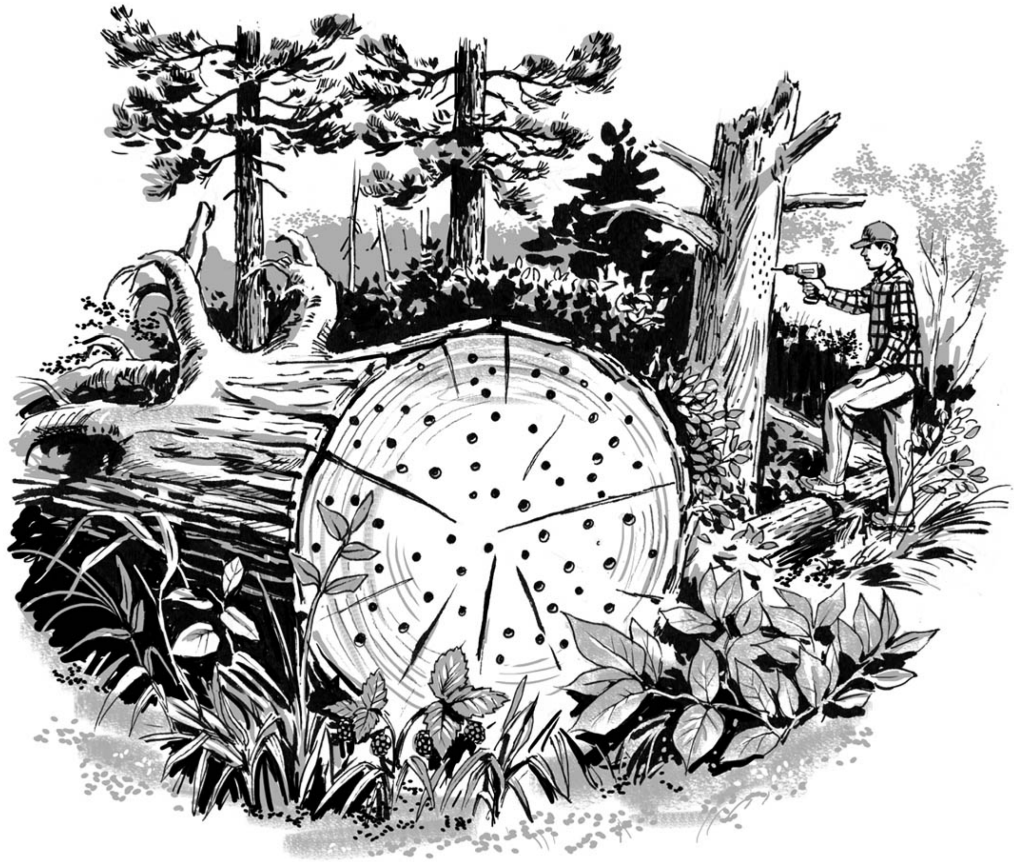
The initial equipment investment is several hundred dollars, but the cost of maintaining a hive over the long term is minimal. If you're a frugal homesteader, you may be tempted to buy used beekeeping equipment; however, in doing so, you're taking a major risk. Diseases such as American foulbrood can perpetuate on old equipment for quite some time and can devastate your colony as well as neighboring colonies. You're better off investing in new equipment. One way to save money on new equipment is to buy a hive kit, as opposed to preassembled boxes, and assemble it yourself with basic tools.

For the beginning beekeeper, the most common way to acquire bees is to purchase a 3-pound "package," which will contain about 10,000 bees plus a queen. Your second option is to purchase a nucleus colony (commonly called a "nuc"), which is a partially established colony. Other options include buying a complete, ready-to-go colony from an existing beekeeper or collecting a wild swarm. In addition to the excitement of finding and capturing a swarm of wild honeybees, you'll have the added benefit of hardier bees that are better adapted to your particular environment. If you decide to pursue a wild swarm, make sure you have an experienced mentor with you for the collection and hive introduction phase.

In your first season of beekeeping, you'll want to be conservative in the amount of honey you remove from the hive. In most cases, you'll only remove one to four combs. The following spring, however, you'll likely be able to remove three to seven combs (though climate, colony vigor, and various environmental stresses may affect your harvest).

ATTRACTING NATIVE BEES

Attracting native cavity bees is an important part of encouraging biodiversity of pollinators. Select dead or dying logs and stumps in areas that are unlikely to be disturbed, are protected from wind, and have good southern exposure. Use a ³⁄₈-inch drill to bore a series of holes ½ inch apart in a grid format. Each hole should be about 5 inches deep, and at least 8 inches above the ground. Encourage colonization by spraying the holes with a 1:1 mixture of sugar and water.



ABOVE: *Create homes for native bees by drilling holes into stumps and snags.*

NATIVE BEES FOR POLLINATING

If you'd like to capture the pollination benefits of bees, but aren't all that interested in the honey, consider creating habitat that will encourage native bee populations on your homestead. One easy method is to take an old, partially intact hay bale, place it in your orchard during late summer, and allow it to decompose a bit over winter. In the spring you'll have a warm microenvironment that's ideal for a queen and her harem in search of a new home.

In addition to honeybees, there are over 4,000 native cavity bees in the United States. They don't produce copious amounts of honey and tend to live in less-organized colonies, but they are just as important to pollination as honeybees are. You can encourage their presence around your woodland homestead by creating habitat. One of the easiest ways to do this is to take advantage of stumps and snags around the homestead. See **Attracting Native Bees**, for more information.

CELLAR AND CIDER: ENJOYING THE HARVEST

Few other activities on the woodland homestead are as rewarding as harvesting apples. The fall harvest stands as a testament to a productive summer, and as the winter larder fills with crates of apples and jugs of sweet cider.

For me, the fall apple harvest and the subsequent cider days are as much about cultivating community as they are about celebrating our self-reliance in putting up food and drink. While my woodland orchard provides me with enough apples to last until spring, and about 30 gallons of cider (most of which I freeze by stocking them in the woodshed), my neighbors and I press as many as 200 gallons of cider within a 3-square-mile community.

This neighborhood feat always involves creative bartering: the apple-tree-poor folks offer the promise of finished cider, jelly, and applesauce to the apple-tree-rich folks in exchange for harvesting rights. I'm happy to support this neighborhood tradition by lending my well-used antique cider press. In return, not only do I get the pleasure of knowing that local resources are being wisely used, and that an important rural tradition has continued another year, but I'm also lucky enough to get the leftover apple pomace. Conveniently, this sweet and seasonally abundant fodder, along with a touch of grain, is usually enough to sustain my hogs until their butcher date. Not a bad deal!

HARVESTING APPLES

Fruit ripens at different rates, depending on its location on the tree. In the early days of fall, you'll find small and often blemished fruits below your tree. Early cidermakers referred to these as the "sheep's share" and allowed flocks to consume the drops. Apparently, these early cidermakers knew a thing or two, as research confirms that these early drops are most likely to be the wormiest of the season. From a pest management perspective, grazing sheep in these areas is a good way to control apple maggots before they complete their lifecycle.

The use of drops for cidermaking is largely a question of tradition and personal preference, though the sooner you can collect them, the better. If you do collect drops, particularly in areas where livestock have grazed, it's important to pasteurize any cider made from them. Pasteurization can be achieved by heating the cider to 165°F, and then rapidly cooling it to minimize enzyme loss.

When I pick apples, I usually carry two sacks, one for the large, blemish-free fruits that will be kept in the root cellar, and a second for the small, blemished ones that will be used for cidermaking. Since I'm picking apples that have never been in contact with the ground (the greatest risk of ground contact being *E. coli* from animals), I opt not to pasteurize. While certainly safer than using drops, even this drop-free cider comes with a bit of risk. It's also important to note that while freezing cider will kill some microorganisms, it will *not* kill *E. coli*. In short, if you think there's even a slight chance your apples may be contaminated, take the time to pasteurize.

PUTTING UP APPLES AND OTHER FRESH FRUITS

One of the chief virtues of apples is that they keep particularly well. In a vented root cellar you can easily keep quality apples for six months. Even blemished apples can be kept for a couple of months without degrading in quality. Later, thicker-skinned, firmer fruit keeps better than early, thin-skinned, soft fruit. As a general rule, mid-30°F temperatures and 90 percent humidity are ideal for long-term storage.

If you have a small apple harvest, you may opt to take the time to wrap the apples individually in newsprint and place them in an open wooden box. This prevents one bad apple from spoiling the lot. Additionally, the wrapping helps contain ethylene gas, which apples (and pears) naturally release but which can expedite ripening and eventually rotting. If you're putting up a larger quantity of apples, the newsprint approach may not be practical. In that case, it's best to carefully sort the apples, removing any soft or bruised ones for more immediate use. I use wooden crates that are stored a foot or so above the root cellar floor. Wire storage baskets tend to result in bruised fruit that spoils easily. Finally, make sure that your apples are stored in a separate room from other fruits and vegetables, since apples naturally release ethylene, a gas that accelerates the ripening process.

Pears can be stored under the same conditions as apples, but will keep only one to three months in storage. Stone fruit is generally best kept by either drying or canning or freezing, due to its soft flesh and perishability. If you opt to freeze stone fruits, remove the skins and pits first.

Cider Switchel

Most cidermakers admit to making at least one accidental batch of cider vinegar. This is usually a result of excess oxygen in the fermenting container, which triggers a switch from anaerobic fermentation to aerobic respiration. If a batch of your cider turns to vinegar, don't despair; make switchel. Switchel is a traditional homestead drink that was popular during haying season as a thirst quencher. To make your own switchel, mix four cups of cold water, ½ cup of cider vinegar, ¼ cup maple syrup, and one teaspoon of ground ginger. Stir and enjoy.

MAKING CIDER

I had the great fortune of growing up behind an apple orchard. My venture into cidermaking began at age seven, when I hauled 5 gallons of apples from the neighbor's orchard and commenced to build my own apple press.

The design was admittedly crude, but it worked. I chopped the apples with my trusty hatchet and wrapped them in a section of cheesecloth that I "borrowed" from my mother's pantry. I then carefully placed the wrapped apple chunks between two boards placed on the threshold stoop of my childhood playhouse cabin. With chunks of scrap wood, I built a precarious tower of lumber that reached to within 6 inches of the top of the door frame and inserted a scissor jack that I "borrowed" from the trunk of my father's car. As I cranked the jack, golden cider ran out the sides into a tin cup below. I was hooked. My cidermaking has evolved a bit since those early days, but the principle remains the same: grind, press, bottle, enjoy.

> *"It is indeed bad to eat apples. It is better to make them all into cider."*
>
> — BENJAMIN FRANKLIN

HOMESTEADER PROFILE

Ravenwood Homestead

Bruce and Nancy Kilgore

Bruce and Nancy Kilgore's homestead, known as Ravenwood, is an artistic and functional expression of what's possible on a woodland homestead. The Kilgores' house is an innovative blend of cordwood construction, post-and-beam construction, and passive solar design. The walls of the home are made of cedar, which was collected from the slash piles left after logging jobs in the area. The roof trusses are made of massive 22-inch white pine timbers that support a living roof that doubles as crop space.

The Kilgores resurrected the woodland apple trees not only for the fruit but also for the bees. Bruce notes that after he introduced bees to his woodland orchard, the size and quantity of apples increased significantly. In addition to producing apples and honey, Bruce also has a 200-tap sugarbush on his property, which he taps along with trees on his neighbors' land as part of a syrup cooperative.

Known for his thoughtful integration of systems, Bruce offers some sage advice to those looking to create symbiotic and efficient systems for the wooded homestead. First, he suggests that before you eliminate one ecosystem component, you should consider what impacts it has along the way. For someone looking to produce fruit, honey, and syrup on the same land, this is going to mean retaining as many early successional species (basswood, aspen, and birch) as possible, because they are, in most cases, the first to flower in the spring, providing an important food source to bees. He also notes that all of his wood from tending the sugarbush becomes fuel wood for firing the evaporator.

Finally, Bruce and Nancy advocate for working with your neighbors and bartering homestead goods along the way. This may mean trading syrup for meat, or honey for labor. The idea is, as Bruce describes, a network in which neighbors lend one another their goods, time, and knowledge as currency in the woodland homestead economy. Taking the advice of the legendary Helen and Scott Nearing, the Kilgores practiced a “pay as you go” philosophy, building in stages, using cash and sweat equity. When asked about the advantages of that approach, Bruce Kilgore grins, saying, “There’s not a bank or mortgage company in this world that knows my homestead exists.”

Before you begin, make sure you have the following supplies on hand:

- **Apple grinder.** Some presses mount the grinder on the actual press, others are a separate unit. The smaller you grind the apples, the more juice you'll be able to squeeze out.
- **Apple press.** If a new press isn't in your budget, consider looking for an old one at flea markets or online. Make sure the pressing screw works smoothly and isn't stripped. Don't worry too much about the wood components, as they're easy to rebuild. Replacement pressing baskets are readily available, too.
- **Plastic cider bucket.** You'll need a bucket below the press to catch the cider. Most presses are too low for a standard five-gallon bucket, so you'll need to find a shorter, wider one.
- **Cheesecloth or muslin.** As you press the cider, small pieces of pomace can work their way into the cider. To avoid this, line the pressing basket with cheesecloth. You can also make a reusable bag out of muslin, which is more durable than the cheesecloth.
- **Sanitized containers.** Make sure you have plenty of sanitized containers on hand. You'll want to bottle your cider right away to avoid contamination and keep from attracting wasps and flies.
- **A plan for the pomace.** After pressing, you'll be left with lots of pomace. Make sure you have a plan in advance, otherwise you may find yourself attracting unwanted wildlife.

Sweating the Harvest

Planning your cidermaking in advance is important to ensure that your apples have enough time to sweat. "Sweating" simply refers to aging your apples for a week or two in a cool place, which softens them up for easier grinding and increases the sugar content. If your harvest is small, you may sweat your apples by leaving them in your collecting buckets. For larger harvests, it's best to pile the apples on a wooden floor and loosely cover them with a tarp. An alternate method is the "cold sweat," in which apples are intentionally left outside (usually in the back of a pickup truck, uncovered) on an evening when the temperature is expected to drop below freezing. This flash-freezing is a great way to age your apples in a hurry, but you must press them the next day.

Washing and Grinding

A large water tub next to your grinder is ideal for washing apples as you pass them into the grinder. Some grinders are separate from the actual press; others are mounted above the pressing basket. If you're making a particularly small batch of cider, you can grind the apples in a food processor. Regardless of your grinding method, make sure that you press the pomace immediately after milling, to avoid attracting wasps and vinegar flies that can contaminate your cider.

Pressing

Old-timers often refer to pressing as "wringing." By exerting pressure on a tub of ground fruit, you're extracting juice from the ruptured fruit cells. Sometimes folks will use cheesecloth to hold the milled pulp. If your pomace is in large chunks and/or the staves of your pressing tub are close together, you may not need to use cheesecloth. Nonetheless, you'll want to let the juice (technically referred to as “must”) pass through a strainer before flowing into your bucket. In terms of collection buckets, never use galvanized, copper, iron, or aluminum containers since the must will react with the metal, making a most unpleasant cider. Instead, make sure you’re collecting in either a stainless-steel or plastic container. As you wring, or press, the cider, you’ll reach a point at which the must tapers off, indicating that you’ve extracted all the juice. Be sure to cover the juice right away; otherwise, it will attract insects in short order.

ABOVE: *A double-tub cider press offers the advantage of pressing one batch while the next is ground. Be sure to save the pomace to feed to your livestock.*

Blending and Testing

Different apple varieties yield ciders with different qualities: some are tart; others are sweet or astringent. While blending can be done during the grinding process, you're better able to control the taste of the final product by blending the cider (by crop and/or variety) after pressing, but before bottling or fermenting. If you intend to consume the cider fresh (not hard), your blend will be based entirely on taste preference. If, however, your goal is to make hard cider, blending and testing will be an important part of controlling the alcohol level of the finished cider.

HOMESTEADER PROFILE

Cidermaker & Tree Farmer

Al Robertson

Listening to Al Robertson describe his 60-acre freehold in Vermont, it's clear that his pruning shears and chainsaw are his paintbrushes. While he was trained as a civil engineer, Al has spent the last 30 years establishing a woodland orchard and tending his forest. In 1985, Al cleared an immature forest to establish his woodland orchard — populated by 30-plus varieties of heirloom apples, which he blends to make award-winning hard cider. The diversity of both varieties and microclimate means that the apples ripen at different times and that Al's able to spread his cidermaking over a longer, less-hectic season. When asked what advice he'd offer to novice cidermakers, Al stresses the importance of sanitation, mixing different varieties, and taking the time with friends to enjoy the cider.

When not making cider, Al can be found in his certified tree farm, practicing a German forestry method known as *Dauerwald*, which aims to create a multi-aged, multilevel forest where trees are harvested either individually or in small groups. Al notes that the success of this system is due in part to an extensive road network throughout his woods that allows for easy access. For other woodland homesteaders, Al recommends taking the time to design and build good roads so that you can maximize the use and enjoyment of your entire property.

Fermenting

Sweet cider changes to hard cider when the sugar in the juice converts into alcohol and carbon dioxide through the growth of specific yeasts under controlled conditions. Like winemaking or beer brewing, the process can vary greatly in terms of sophistication; most cidermakers produce their first batches using a single-step fermentation process in which the yeast (either added or natural from the skins of the apples) is allowed to “eat” until all of the available sugar has been converted to alcohol, thereby slowing and eventually stopping the fermentation process. As you refine both your techniques and your cider palate, you may also look to experiment with secondary malolactic fermentation, which gives cider a smoother finish. To learn more about making hard cider, find a copy of *Cider: Making, Using & Enjoying Sweet & Hard Cider* by Lew Nichols and Annie Proulx. (see **Resources**.)

Bottling

Regardless of whether you’re making sweet or hard cider, make sure your bottles are sterilized prior to bottling. For sweet cider, you may want to consider using clean plastic jugs, which can be frozen until you’re ready to enjoy your cider. Just remember, don’t fill the jugs more than three-fourths of the way, to allow for expansion while freezing.

ABOVE: *Within a few days of pitching the yeast, you'll notice bubbles emerging from the airlock in the bung on your carboy. Allow your cider to ferment in a dark space with the temperature between 45–65°F.*

The Wild Cider Orchard

On sites with relatively alkaline soils, neighboring fruit trees, and ample wildlife, it's not uncommon to find naturally established wild apple trees that produce small, blemished, and often bitter apples. While these wild apples may lack palatability as snacks, consider pruning up the wild trees as part of a homestead cider orchard. If the cider's particularly tart, you can sweeten it by adding honey or blending in sweeter varieties.

THE HOMESTEAD SUGARBUSH

If you spend a bit of time around homestead sugarbushes, it will soon be apparent that sugaring is about far more than making syrup; sugaring is a culture, a hopeful sign of spring, and a reminder that nature's bounty is just below the bark. And if you think that syrup making isn't an option for you because you don't have sugar maple trees on your property, think again. Birch and even walnut can be tapped to make delicious syrup, albeit with a bit of work.

HOW SYRUP IS MADE

Although we think of sugaring as an early-spring activity, the tree actually begins sap production in the fall. At that time of year, trees slow their growth and begin storing excess starches throughout their sapwood. In the case of sugar maples, this starch is overwintered until the wood temperature warms to about 40°F, at which point enzymes in the sapwood convert the starches to sugar. This sugar then moves through the tree as sap to feed newly emerging buds. When a tap hole is bored into the tree, the carrying vessels are severed, allowing the sap to flow out.

The early Algonquians are thought to have been the first sugarmakers. They used stone tools to carve V-shaped notches into maple trees and collected the oozing sap in birch containers. After collecting the sap, they made it sweeter by continually adding hot rocks to evaporate the water, thereby increasing the sugar content and ultimately yielding syrup.

This process of concentrating sugar through evaporation is still the underlying principle of modern sugaring, though both the techniques and the equipment have been greatly refined. At the homestead level, you'll be able to get a taste of sugaring, even if you just have a couple of tappable trees, a few buckets, and a campfire with a wide, shallow pan propped over it. Larger-scale operations with many more taps often set up networks of tubing to collect sap into a central tank and boil it off using commercially made evaporators with drop flues, automatic draw-off values, and reverse osmosis concentration systems.

The Rule of 86

The Rule of 86 is a basic equation that you can use to determine the number of gallons of sap needed to make a gallon of syrup based on different Brix sugar values. So, for sap that has a 2% sugar content: 86/2 = 43 gallons of sap are needed to make one gallon of syrup. Another way to think of this is that you'll have to evaporate 42 gallons of water to make one gallon of syrup.

MAKING YOUR SUGARING CAMP

In the old days, maple camps were erected in forests naturally endowed with a preponderance of maple trees. Often, the men working in these maple camps were loggers and farmers who were looking for work during a time of the year commonly known as mud season, a time the ground was too soft for either farming or logging. While some of these camps were elaborate establishments complete with evaporators and bunk houses, others were crude establishments consisting of nothing more than a lean-to with an open fire and a large cast-iron cauldron for boiling sap.

In establishing your own maple camp, you'll be faced with the same question of how elaborate or simple your setup will be. I'd encourage starting small, which allows you to try out different systems and confirm your own affinity for sugaring before making major investments. The simplest setup is a propane turkey fryer, though if you have wood available, I'd strongly encourage going that route instead. My first sugaring rig consisted of two rows of cinder blocks set about 2 feet apart, with a large, deep commercial cake pan straddling the cinder blocks and a roaring fire below. The open ends allowed wood to be fed from both sides, and a metal coffee can with a pinhole punched in the bottom edge served as a sap preheater that was balanced on the corner of the pan. Preheating the sap, and allowing it to slowly dribble in, means that the pan doesn't lose its boil, thereby slowing down the evaporating process.

Over the course of a couple seasons, you may choose to build a sugar shack with a roof, a "proper" evaporator, holding tanks, and even a few comfy chairs. If you go this route, you may be lucky enough to be able to use the material from thinning the sugarbush to build your sugar shack. In this case, access to a **portable sawmill** will make the whole process much more efficient. What's even better, after milling your lumber, you'll be left with a pile of slabs that makes for great sugaring wood to burn in your evaporator.

IDENTIFYING TAPPABLE TREES

While the sugar maple is king of the maple world, other tree species are suitable for tapping as well. Some of these species, such as the birches, are complementary to sugar maples because their tapping season begins just as the sugar maples are finishing up. Other species, like red maple, have been given a bad rap for their lower sugar content, but can produce syrup equally delicious to maple. This **chart** lists some other tree species that bring the fun of sugaring to regions of the country that rarely get to enjoy the smell of boiling sap on a cold day.

If you're considering tapping any of these lesser-used species, there are several important points to keep in mind. Lower sugar content means more boiling. For those species with less than 1 percent sugar, you'd want to use reverse osmosis to reduce the boiling time. If you're looking for the sweet flavor but don't feel compelled to make syrup, consider a short boil just to make the sweetness more pronounced and serve it as refreshing beverage. Another option is to let your sap partially freeze and remove the ice from the top; the denser sugar water will sink to the bottom.

It's also important to understand a bit about the physiology of the trees you're tapping. Sap from maple and walnut trees relies on a freeze-thaw cycle to produce pressure in the tree. This pressure is what allows the sap to flow from the tap. Birches are different; they rely on root pressure to move the sap once the soil warms to 45 to 50°F. This means that just as the maple or walnut season is coming to an end, the birch season is just beginning.

TO TAP OR NOT TO TAP?

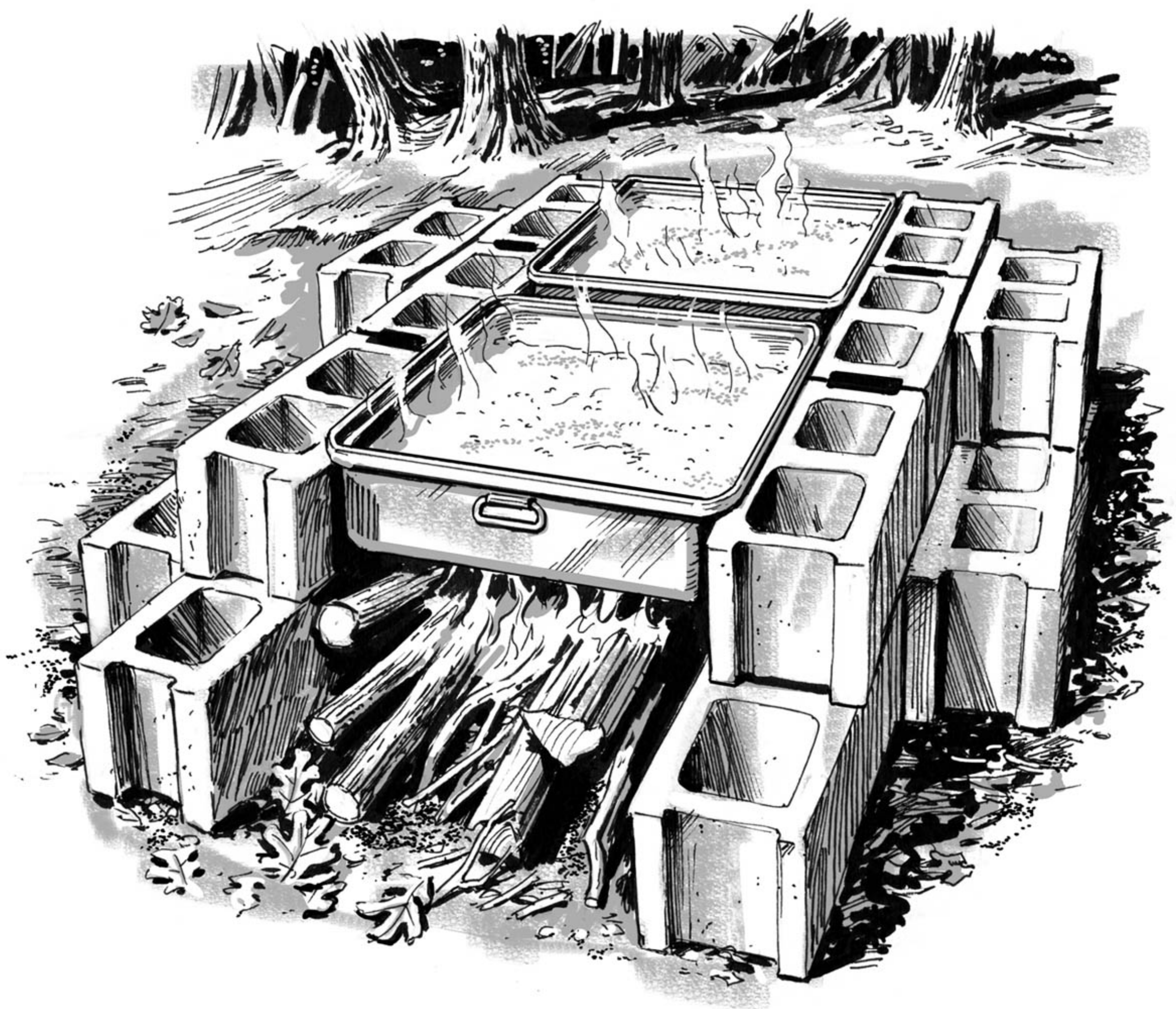
If you're getting ready to tap your trees for the first time, you probably have quite a few questions. Among the most common questions I'm asked is, "Does tapping hurt the tree?" The short answer is "No, so long as it's done properly." The key, of course, is defining *properly.*

First, think of tapping a tree as being analogous to giving blood; you want to make sure the donor is healthy, and don't want to take too much. Look for a tree with a large, full crown and no decay. To ensure that you don't stress the tree by taking too much sap, consult the **Tapping Guidelines**. If you suspect a tree may be stressed, consider reducing the number of taps, or giving it a rest for the season.

It's important to avoid damaging the tree by carefully following the tapping directions below. Equally important is pulling the taps as soon as the sap stops running. This will allow the tree to begin closing the wound, which is normally a 2- to 4-year process.

MAKING MAPLE SYRUP

Sugaring season usually begins in late February or early March, as the days get longer and temperatures push above freezing during the daytime, but return to below freezing at night. Some sugarmakers always start on the same calendar day while others roll the dice based on a long-range forecast. Tap too early, and your tap holes will dry up (think of it as the tree cauterizing a wound) before the end of the season; tap too late and you risk missing a big run of quality early sap. If it's your first time sugaring, watch for others to hang their buckets and follow suit. Having your sugaring equipment ready and a plan in place is key to fast and efficient tapping once the sap begins to run.



ABOVE: *Old hotel pans propped on a cinder block arch makes for an inexpensive evaporator. As the sap evaporates, move it from the rear pan to the front pan, and add new sap to the rear pan.*

Drill Your Tapholes

A standard tap, or spile, is made for a 7⁄16-inch-diameter hole. These metal taps can be found at hardware stores, barn sales, and antique stores. Newer, smaller-diameter plastic taps are available as well (5⁄16 inch and 19⁄64 inch). The advantage of the smaller taps is that the tapping wound can heal faster than with a standard tap. If you opt for a small-diameter tap, only drill in about 1½ inches; for a standard tap, you'll want to drill in 2 inches. You can mark your drill bit with paint or electrical tape so that you drill to a consistent depth. Drill your hole with a sharp bit at a slight upward angle, so that the sap can flow out. Ideally, you'll want to be at least 6 inches left or right of a previous tap hole and 24 inches directly over or under a former tap hole.

What's Reverse Osmosis?

Visit a commercial sugaring business and you're likely to hear the operator extolling the virtues of their reverse osmosis or "R.O." system. This is a filtration system that takes raw sap and forces it through a semipermeable membrane that separates out some of the water, resulting in sap that's close to 10 percent sugar. However, R.O. units are expensive, with even small hobby-size units costing several thousand dollars.

The reason these systems are so valued by surgarmakers is that raw sap is usually around 2 percent sugar (in the case of most maples), but finished syrup is approximately 66 percent sugar. This 64 percent increase in sugar is both energy and time consuming for the producer.

TAPPING GUIDELINES

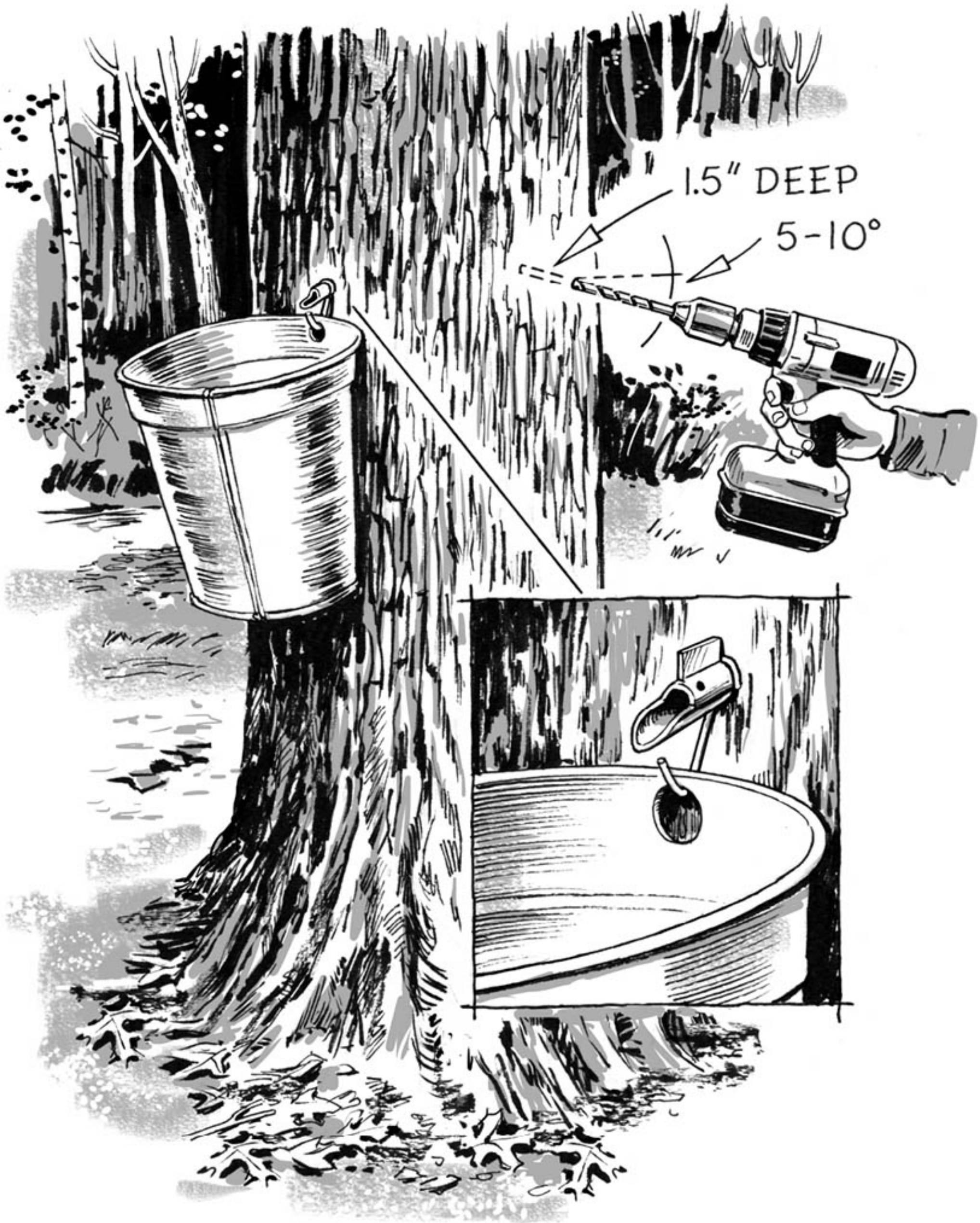
Tree Diameter in Inches (DBH)	Tree Circumference in Inches (CBH)	Number of Taps
10–20	31–63	1
20–25	64–79	2
>25	>79	3

Set Your Taps

Use a hammer or mallet to tap the spout into the tree. You want it to be snug, but not so tight that it splits the wood. As you're hammering the tap in, you'll notice a change in sound as it tightens up; use this as your cue that it's properly secure. Tapping on a warm day, just as the sap is beginning to run, will minimize the chance of the wood splitting and also allow you to make sure your taps are seated snugly and don't leak.

If you're using buckets to collect the sap, hang a bucket on the hook and attach a cover to keep out precipitation and debris. An alternative to the bucket is a translucent sap bag, which is not only cost effective but also allows you to see from a distance how much sap you have collected. One of the disadvantages of buckets is that you can't see how full they are until you walk up to the tree and remove the cover. In a large sugarbush, remembering which buckets you've already attended to can be a challenge. Some sugarmakers paint half the lid, replacing it in the opposite direction so they know from afar that the bucket has already been collected that day.

If you're using plastic tubing, make sure that your drop lines (smaller diameter lines that connect the tap to the main line) are long enough that you're able to tap in "fresh" wood. Also, take the time to walk your line to check for damage from either rodents or falling limbs.



ABOVE: *When tapping with a cordless drill, be sure to pack extra batteries and a sharp bit for making clean tap holes.*

Collect and Boil

The amount of sap you collect during sugaring season will vary greatly from day to day and year to year. Temperature (it needs to be above freezing for the sap to run), barometric pressure, and sunlight all influence the sap run. Some days you're likely to collect several gallons of sap, other days it won't run at all. In time you'll also begin to notice how different areas of your sugarbush and individual trees respond. Don't be surprised if you begin to describe individual trees as being "early," "stubborn," "sweet," or "dependable." (Who said trees don't have personalities?)

In any event, it's important to collect and boil your sap as soon as possible. One good way to keep your sap cool and discourage bacterial growth until you boil is to bury your storage tank in a snow bank. You can then store your sap for weekend boiling parties without having to boil daily or worrying about the sap going rancid. If you don't have an evaporator, you can still make quality syrup over an open fire. The larger the evaporator pan, the faster you'll be able to make syrup. Boiling off the sap in commercial baking pans and old turkey roasters is a good way to get started. Make sure you have plenty of firewood, since boiling off 42 gallons of sap to make a gallon of syrup can take an entire day.

The transition from sap to syrup occurs when your sugar content is 66 to 67 percent. The best way to measure this is by using a hydrometer. You can also make perfectly good syrup using a candy thermometer; however, it requires a bit of calibration based on elevation and barometric pressure. On boiling day, note the temperature at which the sap begins to boil (it should be 212°F +/- a few degrees, depending on elevation); you'll then want to add 7.1°F to that boiling point to arrive at the proper temperature for finished syrup.

Making syrup from start to finish in the kitchen is generally not advisable, though finishing up on the stovetop is a good way to prevent scorching since stovetop temperatures are easier to control. As the sap boils, it will foam up. Adding a dollop of butter or a drip of canola oil will calm things down. A small mesh hand strainer is useful for picking out debris and foam during the boiling process as well.

ABOVE: *If you'd like to upgrade your sugaring hobby from cinder blocks and hotel pans, consider a 2'×4' evaporator capable of handling sap from up to 125 taps.*

Bottle Your Syrup

When your syrup is finished, you'll want to can or bottle it hot in sterilized containers. Syrup that's allowed to cool before canning or bottling can spoil, but it can also be reheated to 180°F. Some folks allow the syrup to cool overnight before bottling to allow the sugar sand (solidified minerals) to settle out. Other folks use coffee filters or, better yet, a felt cone to filter the hot syrup.

In addition to your back aching from hauling sap, there are a few indicators that sugaring season is over. As temperatures rise, bacteria will begin to grow in the sap, making it milky in appearance. Early fly hatches, drawn in huge numbers to your buckets or sap storage area, are another indicator that the season is ending. Once the sugaring season has come to an end, you'll want to make sure you take the time to thoroughly clean all your equipment, using a solution that's 1 part bleach, 20 parts water. Remember, any residual sap makes for an ideal environment for bacteria. Taking time to clean your equipment this spring will yield better-quality syrup next season.

After a six-week season of hauling sap and feeding the evaporator, you'll no doubt be ready to enjoy your harvest. Take time to invite all those who lent a hand during the season and host your own maple breakfast.

> *"A sap-run is the sweet good-by of winter. It is the fruit of the equal marriage of the sun and frost."*
>
> — JOHN BURROUGHS, *SIGNS AND SEASONS*, 1886

SIZING UP YOUR SUGARBUSH

In this section I'll discuss how the maintaining a sugarbush can be combined with other homestead goals. I'll assume that you have sugar maple (*Acer saccharum*) trees, but remember that a wide range of species can be tapped in the spring so long as you have cold nights (below freezing) and warm days (above freezing).

Your sugarbush may consist of anything from a few maples along your fenceline to an elaborate tubing layout that you can grow into with time. The discussion here is targeted to a larger homestead sugarbush since it allows us to discuss a wider range of management options, but many of the concepts are applicable, regardless of sugarbush size.

Site Selection and Stand Structure

If you're fortunate enough to have a woodland homestead that has multiple sugarbush site locations (indicated by an abundance of crop trees), the following guide will help you through the planning process. Begin by setting up your sugaring operation based on one important question: How will you gather the sap? This is a question as much of labor as of the lay of the land. If your long-term ambitions include more than 100 taps, you may want to opt for a layout that allows for a plastic tubing system with a central collection tank. If you opt for a more manual system, using a tractor or horses and buckets, you will need a road or trail network.

If you opt for a tubing system, study your land to see if you're able to use gravity to move the sap to your collection tank. Ideally, your sugarbush will be on an eastern or southern slope, which offers the best compromise between growing conditions and good sap production. If you're using buckets, flatter ground is generally preferable.

Sugar maples prefer deep, well-drained, moderately coarse-textured soils. On less-fertile sites, you'll often find sugar maple intermixed with red maple, basswood, ash, or even white pine. If your property doesn't host many sugar maple trees, consider tapping the alternative species (see here).

Stand Structure and Health

You'll recall from chapter 1 that "stand structure" refers to the size, arrangement, age, and species of trees in your forest. Your goal is to optimize growing conditions for your maple trees so that they're able to develop wide, vigorous crowns capable of producing more sap. Additionally, there will be variability in the sugar content of sap from tree to tree, though the normal range is usually between 1.5 and 4 percent. Studies also indicate that increasing the amount of direct sunlight a crown receives increases sap sweetness.

Given the virtues of creating sites with little intraspecies competition, it would be easy to assume that a monoculture of sugar maples is the perfect sugarbush. Certainly from a production and convenience standpoint this is ideal, but a monoculture also represents trade-offs that should be carefully considered. If you think of your forest as an investment, and apply a bit of investment theory, you'll quickly conclude that eliminating all "non-maples" is a risky proposition.

The risks of developing a monoculture include maple-specific defoliators, increased vulnerability to vascular disease, gradual adverse changes in nutrient relationships, and reduced resiliency. These risks tend to be greatest on sites that are not “ideal” sugar maple sites, where the removal of associated species may cause stress from logging damage, or changes in light conditions that affect the remaining trees. In the interest of sustaining the sugarbush for future generations, we’ll focus on “uneven-aged management” — maintaining crop trees of different ages — in order to ensure a steady supply of tappable trees. In addition to considering forest structure and health, other trade-offs to consider on the homestead sugarbush include retaining alternative tappable species, keeping trees for firewood production, or growing minor forest products.

MANAGING FOR MULTIPLE USES

Since a good sugarbush can and should provide multiple crops, it's important to explore all the possibilities for your own homestead. In some cases, sugaring may be the minor use of your land, with firewood or forage production dominating. There's no right or wrong combination; the goal is to find the combination that is best suited to your needs and the production possibilities of your land. That said, I would encourage you to develop flexible plans that allow for shifts based on changing needs.

THE MULTIUSE SUGARBUSH

As we've discussed, the homestead sugarbush need not be a monoculture of maples; instead it can be a multiuse forest that suits a variety of homestead goals. With a bit of planning, you'll be able to maximize your range of goods and products. As a starting point, I'd recommend making a master list of all the products you hope to produce on your homestead; this long-range planning will play an important role in deciding what stays and what goes in the homestead woodlot.

To illustrate this point, suppose that in addition to producing maple syrup you'd also like to raise honeybees. One key element to raising honeybees is providing a variety of trees with early flowers that provide pollen when it's most needed for survival. Among the best early-flowering trees for bees are basswood, aspen, and dogwood. If you were managing your sugarbush as a monoculture, you would have likely removed these trees as a means of reducing competition. However, entertaining these two goals side-by-side demonstrates how striking a balance among goals will require both a willingness to accept trade-offs and a contemplative mind that's able to appreciate the challenges associated with multiuse management. To that end, consider the following guidelines as just that, guidelines, when tending your sugarbush.

Focus on Crop Trees

While many sugarbush operators will tell you to aim for a specific basal area (40 to 60 square feet per acre is common), you may find it more useful to focus on individual crop trees, especially if you're working with a small or highly variable multiuse sugarbush. Crop trees are released by cutting adjacent trees that crowd, or have the potential to crowd, your crop tree. As a general rule, crowns of adjacent trees that are in direct contact with your crop tree are cut, whereas shrub species and other plants that don't interfere with either the growth of the crop tree, or collection of sap, should be retained for biodiversity. When conducting a crop tree release for the first time, it's best to release the crown slowly, clearing just one or two sides per year; this will help reduce stress and allow the crop tree to adjust to new light conditions. In addition to spacing and maintaining a clear crown, you'll also want to consider other factors that contribute to the selection of crop trees and the overall health and productivity of your sugarbush.

Consider the Health and Vigor of the Trees

At times, managing your homestead sugarbush will require you to act as a tree doctor, diagnosing tree diseases and maladies. You will want to be able to determine whether a disease will result in mortality or is simply a cosmetic or temporary health issue. Various illustrated field guides are available to help you through the tree disease diagnosis process (see **Resources**). This said, if during your crop tree release you're faced with the question of removing a competing tree but aren't sure which one to take, consider the following factors: favor large crowns over smaller crowns, favor straight trees over "leaners," and favor the tree that represents better access and/or more optimal spacing with neighboring trees. In the event that both trees seem equally "good," consider using a refractometer to compare the sugar content of the trees in question. While sugar content will vary from year to year, the relative sweetness among trees is rather consistent.

Consider Wildlife

While wildlife can sometimes be a nuisance in the sugarbush, as any sugarmaker who has had to deal with rodents chewing sap lines can attest to, it can also be an important component for both nonconsumptive uses (like aesthetics and biodiversity) and consumptive uses (like hunting). Hunters appreciate the relatively open forest structure of sugarbushes, which allow for clear shots, while birders appreciate the open canopy structure for observing birds. Removing thinned trees for firewood is practical, but also consider **girdling** some as a way to provide habitat for cavity nesters like woodpeckers.

Consider the Future

Since your trees should be at least 10 inches DBH before being tapped, it can be tempting to create a sugarbush with just big trees, removing all the smaller trees and undergrowth. While this approach will create a parklike setting with wonderful access, it's important to consider what will replace the trees you cut, long after the big trees have been "tapped out." Promoting a new age class of crop trees is important and will allow you to establish a sugarbush that benefits future generations of sugarmakers.

OTHER TREES TO TAP

Species	Distribution	Sugar Content (% Brix)*	Tapping and Syrup Notes
Bigleaf maple (*Acer macrophyllum*)	Pacific Northwest	1.0–2%	While having lower sugar and sap yields than eastern species, bigleaf (also known as western maple) has a unique use for a species traditionally regarded as a "weed tree without commercial use."
Black maple (*Acer nigrum*)	Great Lakes and upper Midwest	2–3%	A close cousin to the sugar maple, black maple yields high-quality syrup.
Box elder (*Acer negundo*)	Most widely distributed of all maples; most of continental U.S. and Canada	1.5–2%	Found on marginal sites, box elder has a low yield, but represents a use for a species that has little commercial or utilitarian value.
Canyon maple (*Acer grandidentatum*)	Rocky Mountains, south to Texas	2–3%	Canyon maple has a similar sugar content to sugar maple, but has low sap yield per tap.
Norway maple (*Acer platanoides*)	Eastern U.S. and Canada, as well as the Pacific Northwest	1.5–2.5%	Commonly planted as an ornamental tree (and considered invasive in some states), Norway maple yields a sap suitable for syrup production, but the sap may become milky earlier than that of other maples.
Red maple (*Acer rubrum*)	From southeastern U.S. to southern Canada	1.5–2%	A generalist species, red maple can be found in both wet and dry areas, and is actually more common than sugar maple. Sap generally has a lower sugar content than sugar maple, and less sap, but yields quality syrup.
Silver maple (*Acer saccharinum*)	Eastern half of the U.S. and extreme southern Canada	1.0–1.5%	Most commonly found on wet sites, silver maple has a comparable sugar content to red maple, but sap yield can be highly variable
Black walnut (*Juglans nigra)*	Eastern U.S. and southern Canada	1.8–2.5%	The syrup of the black walnut has a unique nutty flavor. The lumber is extremely valuable, so target UGS (not AGS) for tapping.

Species	Distribution	Sugar Content (% Brix)*	Tapping and Syrup Notes
Butternut	Upper Midwest and	2–3%	In addition to producing sweet nuts and beautiful lumber, butternut makes delicious syrup; just be sure

(*Juglans cinerea*)	Northeast		to filter out the pectin sap, which causes it to prematurely thicken before boiling.
English walnut (*Juglans regia*)	Eastern U.S.	1.8–2.5%	This hardy walnut is suitable for USDA Zone 5. Syrup has an intense flavor similar to that of black walnut.
Black birch (*Betula lenta*)	Eastern U.S., with the exception of the most northeastern latitudes	0.3–0.9%	Better known as the birch beer tree, this species is equally suitable for tapping, though sadly, the syrup doesn't taste like birch beer.
Paper birch (*Betula papyrifera*)	Northern U.S. and Canada	0.3–0.9%	Paper birch has the highest sugar content of the birches, though it rarely reaches over 1% sugar.
Yellow birch (*Betula alleghaniensis*)	Eastern U.S. and southern Canada	0.5–1%	Yellow birch commonly grows alongside sugar maple. The sap from the two species can be blended when boiling since the sap runs for each frequently overlap.
Sycamore (*Platanus occidentalis*)	Eastern U.S., with the exception of the most northeastern latitudes	N/A	Relatively little data exists on the sugar content of sycamore. Its syrup has a butterscotch flavor.

*The wide sugar-content range presented for each species is influenced by both the growing site and the genetics of individual trees. These should be considered general guidelines. To measure the exact sugar content of your trees, you can use a refractometer, which your local Cooperative Extension office may provide for testing purposes.

EXPERT PROFILE

Meet Dr. Maple

Michael Farrell, PhD

Dr. Michael Farrell is director of Cornell University's maple research field station in Lake Placid, New York, where he taps more than 5,000 trees. The field station is both a commercial-scale production facility and an important research hub that tackles maple-related issues from forest health to the economics of sugaring.

From the moment you meet Michael, one thing is clear: he wants nothing more than to make the sugaring experience accessible to as many people as possible. To that end, Michael has emerged as a leader and advocate for alternative species tapping, a practice that expands syrup making beyond the geographic range of sugar maple, thereby making sap and syrup production possible in every state but Hawaii (though he's quick to point out that Hawaiian palm sap could be collected, too).

In addition to promoting alternative species for tapping, Michael is quick to name off a whole host of other goods that people can incorporate into their sugaring operation, including wild edibles, medicinal plants, florals, and his particular favorite, taphole maple lumber.

Taphole maple is a good example of just one more unique product that can be harvested from your homestead sugarbush. Traditionally, tapped trees were regarded as only suitable for firewood because of the stains and holes associated with tapping. However, just as bird's-eye and curly maple are increasingly sought after for their unique qualities, so is taphole maple. As Michael explains, the added value isn't just about the beautiful multicolor wood but also about nostalgia, knowing that each board contains the history and indelible mark of a sugarmaker's tap.

"Taphole maple is a good example of just one more unique product that can be harvested from your homestead sugarbush."

CHAPTER 7

Farming the Forest Floor

Nuts, Berries, Mushrooms, and More

With all the products provided above the forest floor, a person could be forgiven for overlooking all the goods that lie at his feet. This chapter will examine a variety of edibles, as well as several medicinal plants, that can be grown, managed, and collected on your woodland homestead. While we'll focus on some of the most common forest crops, taking the time to learn about other useful plants that are well suited to your particular region will not only result in more successful production but also be an important part of preserving traditional rural knowledge.

HÜGELKULTUR: A WHOLE-TREE COMPOSTING SYSTEM

Admittedly, my entry into hügelkultur was a bit inadvertent. I was in the process of removing stumps from a pasture using the pig-o-tiller method (see chapter 3), when I realized I had an abundance of stumps piled up. I had constructed several stump walls as barriers but was now interested in getting stumps to decompose, rather than building with them. It was at this point that a friend suggested hügelkultur, noting that it was in perfect alignment with my goals as a stump-rich, soil-poor homesteader.

Hügelkultur, which literally means "hill culture," is said to have originated with German farmers who wanted to find a use for stumps and debris that resulted from clearing cropland. In its simplest form, hügelkultur is burying woody debris under layers of soil and compost, to create deep, rich, water-retentive beds.

BUILDING THE BEDS

Hügelkultur beds are meant to be productive growing spaces that some have described as oversize raised garden beds.

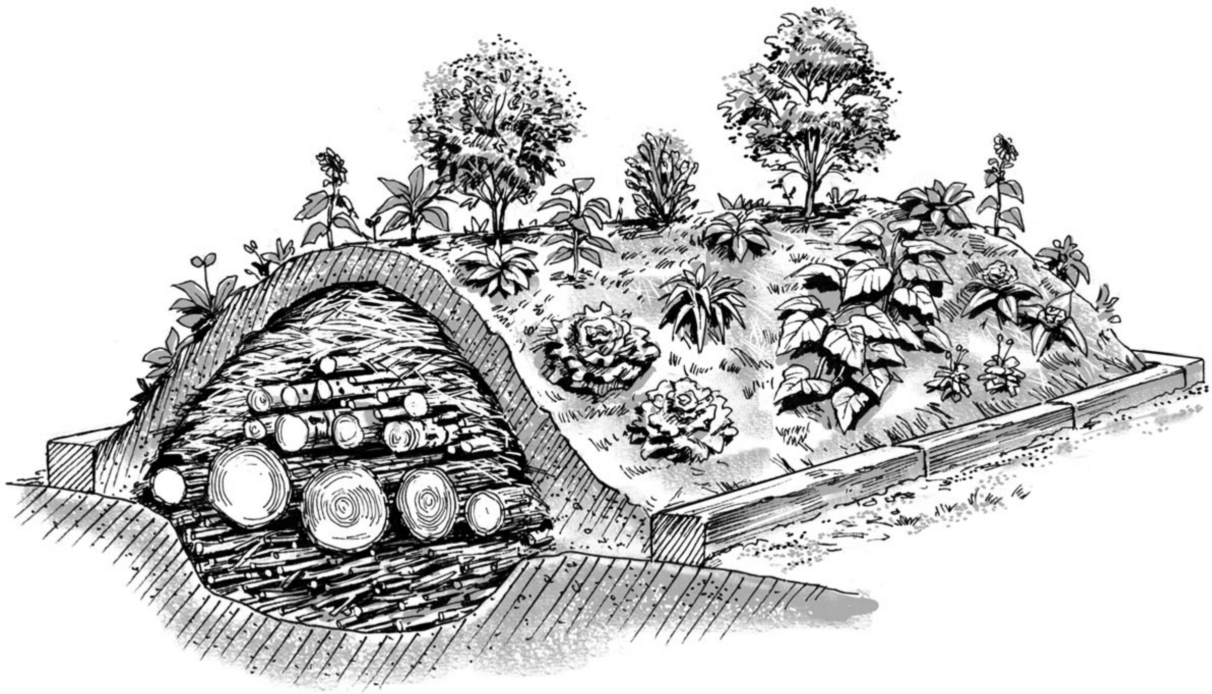
Choose a site. Start by planning out the location and orientation for your hügelkultur bed. Since the bed will have opposing slopes, or planting surfaces, you'll have the advantage of creating two different microclimates on opposite sides of it. East–west orientation will create an early growth southern bed on one side and a later-season bed for hardier crops and perennials on the other. The bed can be lengthened over time, so make sure to allow room for expansion.

Gather materials. Once you've determined a good location for your hügelkultur bed, take stock of your materials, which should include stumps, logs, brush, and some sort of mulch material, preferably containing animal manure. If you find yourself running short of woody debris for your hügelkultur bed, check with your local waste-disposal programs. Many municipalities collect woody debris and landscape waste to keep it out of the landfill and often allow gardeners to cart away the material. Free nutrients for the taking!

Dig the trench. While hügelkultur beds can be constructed entirely by hand, the process can be expedited with the aid of a tractor outfitted with a bucket loader and backhoe. Excavate a trench equal in depth to coarsest materials you'll be adding (i.e., equal to the diameter of the largest logs or stumps that will form the base). As you begin, be sure to set aside the sod which will be inverted and used to top-dress the bed later on. The width of the trench should be equal to the overall height of the final hügelkultur bed. Starting the bed in a shallow trench will give future plants access to minerals and macronutrients that are best obtained from the subsoil, as well as tie the bed into the existing fungi-rich rhizosphere.

Add layers of woody debris and mulch material. Once the trench is dug, begin by laying in your coarsest debris, including stumps and logs. If you're able to pull the old stumps and move them to their new hügelkultur home on the same day, you'll be more successful in preserving saprophytes and other beneficial soil fungi. Minimize the addition of green conifer material that's rich in tannins and of pine boughs. Aspen, willow, and birch (all coppice species) decay quickly and have reasonably good nutrient content. Once you've established your first layer, add a layer of grass clippings and leaves or, even better, soiled animal bedding.

Add a final layer of soil. Continue this layering process, with successively smaller woody debris toward the top, where you'll add the final soil layer. The height of the bed will depend on both its intended purpose (are you making this bed so you won't need to bend over at harvest time?), and available materials (the beds can be added to over time). The depth and quality of the soil layer should be determined by the types of crops you wish to grow. In time, layers of thick humus will develop as your hügelkultur bed ages. In the beginning, however, it's best to plant shallow-rooted, crawling plants like squashes, melons, and strawberries. You can also use your hügelkultur beds to establish perennial gardens; this will maintain a constant cover (thereby reducing the chances of erosion) and make low, backbreaking berry picking a thing of the past. Over time, as the woody material within breaks down, you may notice an increase in termites and wood borer beetles. In this case, set up portable poultry net on the beds and let your chickens earn their keep.



ABOVE: *Hügelkultur beds create a nutrient-rich environment that's effective at retaining moisture during drought and offers a convenient height for harvesting the crop.*

HÜGELKULTUR THEORY

Because of their abundance of wood, hügelkultur beds are a carbon-rich environment; in fact, they are sometimes *too* rich. When green wood is introduced into your hügelkultur bed, you can end up with an off-kilter carbon-to-nitrogen ratio (recall our discussion of ramial wood chips in **chapter 6**), where, at least in the short-term, surrounding plant matter (including your potential crop) may be robbed of essential nitrogen. To counteract this potential nitrogen deficit, you can enrich your hügelkultur bed with nitrogen-rich fertilizer (it's time to clean the chicken coop anyway, isn't it?) or, alternatively, add partially rotted wood to your bed as a source of nitrogen.

As the wood decomposes, pockets are created within the bed. These pockets allow for both water and nutrient transport, but are also habitats for bacteria and fungi. As decomposers do their job, the hügelkultur bed will begin to shrink. My 6-foot bed shrank to 5 feet in a period of three years; it is now the perfect height for harvesting.

Perhaps the most noticeable difference between these and conventional raised beds is the water-retaining capacity of hügelkultur beds. Unlike conventional beds, which dry out easily, hügelkultur beds are essentially giant sponges, holding huge amounts of water in their decaying logs. The level of water retention corresponds to the total mass of the wood, so the bigger the bed, the more moisture it will hold.

HÜGELKULTUR 2.0

Once you've had the opportunity to experiment with hügelkultur, you'll likely think of other ways to use hügelkultur beds on your homestead. Some people design the ends of their hügelkultur beds so that they're exposed; they can then inoculate the ends of the logs with mushroom mycelium, for an additional edible crop.

When hügelkultur beds are planted in rows 20 to 30 feet apart, you're left with valleys between the beds that make for ideal row orchards as water and nutrients run off the bed and toward your orchard trees. Dwarf trees are best for this application, since you don't want to shade the hügelkultur beds.

Finally, consider experimenting with different-shaped beds to suit your space and specific crop. Variations include the pyramid design, the rock-wall design, and the timber-ledger design. Both the rock-wall and timber-ledger design can be added to existing hügelkultur beds to minimize erosion.

CULTIVATING FOREST EDIBLES

On a fairly regular basis, I hear from folks who tell me their dreams of having an "edible landscape." I often ask them to describe their woods; invariably, what they describe is a setting that in many cases already contains a variety of edible fruits, berries, nuts, and mushrooms, among other things. What they're missing is a tuned woodland eye that tells them where to look and how to expand cultivation of a desired species once it's found. Let's take a look at some of the most common forest edibles as well as a few tricks of the woods to encourage them on your woodland homestead.

BLACKBERRIES AND RASPBERRIES

As you survey your woodland homestead, note the areas where blackberry and/or raspberry (*Rubus* spp.) appear. Maybe you know a bit about the history of your land; if so, what can you recall about past activities on the site where the berries are found? In most cases, the answer is the same: logging, land clearing, mowing, or other activities that increased sunlight and disturbed the soil, often complemented by scarification. Once the ground warmed, dormant seeds germinated, resulting in a berry patch.

Natural berry patches can be reasonably short lived (less than 10 years), unless shade is kept at bay and canes are regularly pruned. The basic procedure is the same for both raspberries and blackberries, but it's important to realize that blackberries aren't quite as vigorous as raspberries, so it's generally advisable to remove fewer canes when pruning. Both types of berries reproduce through suckering, so your berry patch will expand if there's enough available light and space.

Expanding Your Berry Patch

You can promote the establishment and expansion of berry patches by creating forest gaps and edge habitat, and then scarifying the soil by raking it in the fall. The most important part of scarification is to make sure you get below the duff, exposing dormant seeds to mineral soil. If you live in a part of the country where raspberries or blackberries are commonly found, chances are good there are dormant seeds in the soil, so you can probably avoid the expense of purchasing cultivated varieties of brambles, which in many cases are susceptible to diseases carried by wild varieties.

Restoring a Wild Bramble Patch

Begin by pruning all canes that bore fruit last year; they won't fruit again. Typically, these canes have peeling, purplish-gray bark. If the stems are too thick or woody to remove using hand shears, use loppers, cutting them back to within 4 inches of the base.

Remove any spindly or short canes as well, and any canes that grow sideways. Remember that the fruit needs sunlight to fully develop.

In the case of blackberries, prune the growing tips of all new canes to encourage side shoots (laterals). This is where next year's blackberries will grow.

STRAWBERRIES ON THE FOREST FLOOR

If we think of the woodland homestead as edible layers, wild strawberries are on the ground layer, often located at woodland edges. Wild strawberries are smaller than cultivated varieties, which are a hybrid of the wild strawberry and a European species.

Fields and open lawns commonly host the Virginia wild strawberry (*Fragaria virginiana*), known for its exceptionally sweet berries and geographic distribution, which includes the entire continental United States. In forests and woodlots, you're more likely to encounter the woodland strawberry

(*Fragaria vesca*), which can tolerate shade better and produces fruit that is larger than the Virginia wild strawberry. The woodland strawberry is sometimes sold by nurseries under the name “alpine strawberry.”

While wild strawberries can be grown from seed, your chances of success are greatly increased by transplanting established plants. The best time to transplant is in the early spring, just as the new growth appears. Plants can be gently lifted and the crowns pulled apart. Top-dress your transplants with a thin layer of compost, and water them daily until they’re clearly established. Strawberries spread by stolons (aboveground runners), and you can encourage their movement in a particular direction by rearranging the stolons.

One drawback to growing wild strawberries is their diminutive size. An alternative is to select a larger cultivated variety (also known as a cultivar). When choosing among cultivars, consider when they fruit, their resistance or susceptibility to particular diseases, and size or taste characteristics. If you intend to eat the strawberries fresh, consider an everbearing cultivar. If you primary use is canning/freezing, consider early-season cultivars in warmer climates and late-season cultivars in cooler climates.

NUTS AS A FOREST CROP

Nuts are an important crop on the woodland homestead — packed with protein and easy to preserve. Throughout this section, we’ll examine some of the most common nut trees found on the woodland homestead, as well as some of their less common uses, both gastronomic and utilitarian.

Acorns

Traditionally, acorns were valued as a high-calorie, versatile food staple that could be roasted, boiled, or ground into flour. Acorns are extremely high in tannins, and any attempt to eat most raw acorns will make your mouth pucker with astringency. There are a few “sweet oaks,” such as the emory oak (*Quercus emoryi*) of the American Southwest, which are sweet enough to eat off the tree, but in most cases boiling the acorns is the key to making them palatable.

> *“Certain crop-yielding trees could provide useful substitutes for cereals in animal feeds as well as conserve the environment.”*
>
> — J. R. SMITH, AUTHOR OF *FOREST CROPS*, 1929

Shelling and Leaching

After you’ve collected your acorns, remove their caps and husks. Instead of using a conventional nutcracker, I recommend using pliers. These will allow you to pop the cap off, while simultaneously giving the nut a gentle squeeze to crack the husk and allow you to peel out the kernel. Once you’ve managed to amass a bowl of acorn kernels, you’ll need to leach out the tannins. You have at least two options for this: you can process them whole, or you can grind them for meal.

Processing whole kernels. Boil the whole kernels in at least two changes of water to leach out the tannins. After the kernels have been boiled, place them on a baking sheet, salt them, and bake for 20 minutes at 200°F before enjoying as a snack.

Making acorn meal. Another option is to make acorn meal, traditionally used by Native Americans for thickening soup and for making acorn cakes. In this method, the kernels aren't boiled until after they've been coarsely ground in a grain mill or food processor. Using ground instead of whole kernels speeds up the leaching process. Place the ground acorn meal in a bowl, pour boiling water over them, and let them stand for half an hour. Taste the meal; it should be both sweet and astringent. If you want the acorn meal to be sweeter, pour more boiling water over them.

Once you're satisfied with the sweetness of the acorn meal, remove it from the bowl and press it in a clean tea towel to squeeze out the last bit of water. Next, spread it on a cookie sheet and allow it to slowly dry in the oven on the lowest heat setting possible. Or, better yet, place the meal outside on a sunny day; just make sure the squirrels don't find it. The final step is to run the coarse-ground meal through your grain mill, on the "fine" setting. The finished meal will store for a couple of weeks on the shelf, or you can freeze it for up to six months.

Acorns for Animal Fodder

Historically, the other main use for acorns was animal fodder (see **chapter 3**). While a variety of livestock — including cows, sheep, and goats — have all been successfully raised on acorns, pigs thrive like no other on an acorn diet. Because acorns are rich in both fat and protein, the U.S. Department of Agriculture examined the potential for pasturing pigs in oak stands in the early 1900s and concluded that “a bushel of acorns makes 6.6 pounds of pork,” thereby being equal to “ten good ears of corn.” In addition to demonstrating the long tradition of using nuts as animals fodder, these early records also highlight a time when resourcefulness was valued as much as modern metrics of efficiency like carcass yield and rapid weaning.

Walnuts

The black walnut (*Juglans nigra*) is the walnut native to North America. It’s a cousin to the butternut and hickory nut, but it holds the distinction of having the tastiest of nuts (however difficult to access through its thick shell). At times, I’ve considering nominating walnut splitting as an Olympic sport: it requires strength, stamina, and perseverance. However, at the center of the tough shell is a meaty gem that’ll reward your taste buds like few other nuts will ever do. When folks ask how it compares to the English (Persian) walnuts that you find at the grocery store, I often describe it as the difference between a sweet wild strawberry and the large but tasteless strawberries in the produce aisle. Black walnuts are rich, buttery, and have a pleasant, lingering flavor.

Harvesting. In most parts of the country, walnut harvesting begins in October, when the nuts fall to the ground, allowing for an easy gathering. The green hulls will begin to discolor and decompose soon after hitting the ground, but in most cases the nuts inside are still good. Before you begin harvesting, make sure you’re wearing old clothes and gloves; walnut hulls will stain your clothes yellowish-brown. When gathering walnuts, exclude those that feel noticeably light (but don't worry if you find insects or grubs in the hull).

Hulling. The process of hulling the nut can be done several ways. In you live in an arid part of the country and the hulls have begun to dry out, you may find that you can simply peel the hull where it's begun to separate. More likely, though, the hull will still be well attached; in that case, use a knife to cut a ring around the hull, then twist to release the nut inside. Another method is to make a "hulling press" out of a 2 × 4 about 2 feet long. Lay the board flat with a block under each end, and drill three holes of varying diameters in the top: 1¼ inches, 1½ inches, and 2 inches. Use a hammer or rubber mallet to pound each walnut through the appropriate-size hole in the hulling press. You'll then be able to peel away any remaining hull. If your walnut harvesting falls a bit late in the year, you may be left with gooey hulls. In this case, these partially decomposed hulls can usually be peeled without aid of a knife, or (as one friend did) peeled with a pressure washer.

ABOVE: *In humid regions, walnut hulls may not dry and peel easily as they do in arid regions. Building a hulling press can make this difficult task much easier.*

Curing. Once all your walnuts have been hulled, wash them and place them in an onion or citrus sack to dry and cure for about two weeks. To prevent mold, make sure the curing area is well ventilated. Leaving them to hang in the sack is the easiest way to store them for extended periods.

Shelling. Once the walnuts have cured, the hard work of shelling the nuts begins. Unlike English walnuts, which come out in perfect halves, black walnuts will likely come out in pieces; but don't despair, these pieces are far superior in taste to any other nut. I use a 16-ounce hammer and a wood-splitting block as my primary tools for accessing the meat. However, to keep the shell and meat from flying, I wrap each nut in a towel prior to hammering. Usually two or three strikes are all it takes to shatter the shell.

Picking the nutmeat. Before you celebrate, keep in mind that cracking isn't the final step of the process; your nutmeat is still firmly connected to the shell and must be teased apart. This can be rather frustrating unless you have the right tools. Diagonal wire cutters are ideal, allowing you to snip the connective tissue between the meat and the shell. To shell a pound of walnuts takes me about three hours, which means you'll chew slower not just because of their rich taste but also out of appreciation for the labor investment.

Storing the nutmeat. Raw walnuts can be kept for up to two years in the freezer using airtight bags. I prefer to eat black walnuts raw, but some folks bake them with a bit of maple syrup.

Using the shells. The hulls and shells have several innovative uses. Because the walnut shells are so hard, they make a wonderful abrasive for "sandblasting" old tools. You'll have to grind (or hammer) them to the consistency of sand, but the result does a fabulous job without eroding the metal. If you accumulate a large quantity of the shells, you can burn them as "firewood" — amazingly hot!

As for the spent hulls, they contain an allopathic compound known as juglone, which inhibits the growth of many plants (besides walnut trees). Directly applying the hulls on sites where you’re trying to inhibit woody plant growth is highly effective. The hulls (and shells, too) can be used to make a brown wool dye; boil 4 gallons of water with 1 gallon of hulls/shells, and 1 cup of salt to help set the color. Wet the skeins in water, and then put them in the slurry.

Chestnuts

Chestnuts belong to the same family as oak and beech (Fagaceae), with European, Asiatic, and American species all cultivated for their edible nuts. At one time, American chestnut (*Castanea dentata*) was among the most valued and prolific tree species on farms and homesteads, accounting for nearly one of every four trees in the Appalachian forest. Its wood was prized for timber frames, tool handles, and fine furniture. The trees also provided a copious supply of nuts that sustained both homesteader and livestock through the long winter months.

Sadly, though, in the early 1900s many trees were discovered with chestnut blight, which likely entered the United States on Chinese nursery stock. Within 40 years, the nearly four-billion-strong American chestnut population in North America was decimated. Over the last century, various disease-resistant, nonnative species have been planted, thereby preserving many of the uses associated with the chestnut. More recently, a process known as back-breeding has allowed for genetic material from disease-immune Asiatic species to be crossed, and then recrossed, with a small population of American chestnut trees that survived the blight, resulting in a disease-resistant American chestnut. While many of these disease-resistant American chestnuts are still in their infancy, foresters are hopeful that this ecologically significant tree may make a return to our woodlands. Fortunately, Asiatic and European chestnut species are well established throughout North America, particularly as ornamental trees, though they are sometimes also planted in forest gardens.

Harvesting

Like walnuts, chestnut fruits are mature when they fall naturally from the tree. The nuts ripen in late September and October and gain half of their final weight in the final two weeks before falling, so there’s little point in harvesting green nuts before they hit the ground.

ABOVE: *Chestnuts are harvested in September and October. Be sure to collect them soon after they fall, to minimize chestnut weevil damage.*

Hulling. The husk of chestnuts is thick, with sharp, stiff bristles and two or three nuts inside. Wearing leather work gloves, you can remove the husk to release the nuts. Another approach to releasing the nuts is to step on the husk and roll your foot so that the nuts pop out the side. Once the hull is removed, many growers recommend soaking the nuts in hot water (120°F) for

20 minutes before storage, to kill any chestnut maggots that might be lurking. At this point, you can either preserve the nuts in their shell by hanging them in an onion bag for future use, or you can roast them in the oven (or in a Dutch oven over an open fire) and enjoy.

Roasting. Regardless of your roasting method, you'll need to cut a slice in the shell so that the nut roasts evenly and the moisture inside has a way to escape. Some people cut an x in the shell, though a single cut across the center of the shell seems to work just as well and is a safer cut to make. If you're working with cured chestnuts, they may benefit from parboiling to soften the shell before cutting. Roast the chestnuts on a cookie sheet at 425°F for 30 minutes, and then open the shell along the incision. The roasted chestnuts can then be salted and eaten as a warm treat or used to make a hearty stew.

MUSHROOMS IN THE FOREST

To harvest mushrooms from your woodland homestead, you have two basic options: forage for wild edible mushrooms or cultivate them. Since identifying wild mushrooms can be tricky, you might want to start with cultivating mushrooms as your first foray into the world of fungi. The process of cultivation through inoculating a chosen substrate (such as a log or stump) with a particular species of fungus is straightforward. The simplest inoculation method relies on "spawn plugs" that are tapped into a series of holes drilled in a fresh log or stump, then sealed over with wax.

Choosing which mushroom to cultivate is a matter of personal preference, based not only on how you'll use them but also on how easy they are to grow. Morels, for example, are extremely tasty but also extremely difficult to cultivate. The mushrooms selected below are all well suited to beginners, and to being grown in the homestead woodlot.

Finally, it is worth noting that as you tend your woodlot, you'll likely accumulate a large amount of pole-size wood, which is perfect for cultivating a variety of mushrooms. Again, this is an example of how a single activity can provide multiple benefits.

Choosing Your Fungus

Spore plugs are available for dozens of different fungi. Experimentation will allow you to identify those species best suited to your particular microclimate. This section discusses three easy-to-grow species that are suitable for a variety of regions and known for excellent flavor and yield.

Shiitake Mushrooms *(Lentinula edodes)*

The shiitake mushroom is perhaps the most popular cultivated mushroom in the world, growing naturally on Asian oaks and beeches. If cultivated on denser wood species, it can produce for up to 10 years. Softer woods, like aspen, will decompose in as little as three years. Shiitakes enjoy diffuse light, meaning that they shouldn't be in direct sun or dense shade. It's best to harvest them when the margins of the caps are still slightly rolled, representing the highest-quality mushroom. In addition to being easy to cultivate, the shiitake is popular for its nutritional qualities, which include D and B vitamins, trace minerals, and protein.

Reishi Mushrooms *(Ganoderma lucidum)*

Commonly found in oak, maple, and hemlock forests, the reishi grows best in a truly moist environment. In Asia, one common cultivation method is to partially bury inoculated logs and then create a small plastic hoop frame over the log pile. It generally takes six months to two years for the first flush of mushrooms, but the logs will continue to produce for four to five years.

Tree Oyster Mushroom *(Pleurotus ostreatus)*

The beauty of the oyster mushroom is that it is the easiest mushroom to grow. In some parts of the developing world, it has been used as a rural economic development tool. The oyster mushroom is most common in lowland hardwood forests and can be cultivated on virtually any hardwood species. In addition to the wedge-cut method described **here**, oyster mushrooms also do well in logs 10 to 16 inches in diameter and 4 feet long that are planted vertically in the ground, 1 foot deep, and inoculated with plugs.

CHOOSING THE RIGHT MUSHROOM HOST

Which mushroom species are best for cultivating? For most mushrooms it's more about having proper habitat than targeting a specific species, though all mushrooms prefer cool, moist, well-shaded areas. You should always use inoculation logs that have been cut from a live tree. It's tempting to use a dead or dying tree, but chances are good that it's already inoculated with other fungi or pathogens. It's also important that the bark is intact. This can be a challenge since the best time of the year to cut mushroom logs (spring) is also the time at which bark is most prone to peeling as a result of sap flow. Carrying, instead of dragging, will go a long way toward preserving the bark. Oak, maple, and beech are preferred species, with aspen, birch, basswood, and alder being alternative choices.

Selecting Sites and Species

With a bit of planning, mushroom cultivation can be a side activity with impressive yields. The idea is to inoculate your chosen logs — that is, to inject them with mushroom mycelium (the part of the fungus that colonizes the substrate, and from which the mushroom fruits). While some fungi grow on softwoods, we'll focus on mushrooms that grow on hardwood species. Start the mushroom season in early spring by cutting your cultivation logs. Early spring is when the moisture and sugar content is highest, thereby making it the optimal time to cut mushroom logs.

Since mushrooms love moisture, it's best if you can keep the inoculated logs in a shaded, moist area of the woodlot. North slopes are optimal. Another factor to consider is wind; high, windy sites tend to be poor for mushroom cultivation because the spores can easily dry out. You'll also need to water your mushrooms throughout the season; locating your inoculated logs near a water source will certainly make the process easier.

As you're searching for your ideal mushroom site, note other mushrooms in the area. As a general rule, it's best to avoid sites with obvious mushroom populations, since they may colonize and outcompete your mushroom spawn. As you become more experienced in mycology (i.e., the study of fungal life), you may identify and cultivate species of mushrooms that behave in mutually beneficial ways, eliminating concerns of competition.

To site the log, consider either the log cabin or tipi arrangement. If you're concerned that water might be a limiting factor, go with the tipi arrangement, as it will allow the log to draw water out of the ground like a straw. Keeping the logs damp is important; many mycologists water their logs as often as they water their gardens.

Many old-timers insist that for a good crop, you need to "knock" the log, which is thought to stimulate the mycelium, just as a falling branch would. To me, it seems like a bit of a folk tale, but why not?

If you're inoculating various logs in your woodlot, you may want to tack a metal tag in the end of the log to identify the species and inoculation date.

Stump Cultivation

In addition to growing on small logs, you can also cultivate mushrooms on stumps. Fresh stumps make excellent cultivation sites, because their root systems continue to function, pumping water and nutrients long after the tree has been cut. Stump tops can be drilled and plugged on 6-inch spacing, as described here. Another method involves using sawdust spawn, applying it to a series of wedges cut on alternate sides of a high stump. In addition to creating great mushroom habitat, this method also gives you a chance to practice the open-faced chainsaw notch discussed in chapter 2. There is also a third inoculation method whereby you add spore oil to biodegradable bar and chain lubricant as a way to inoculate stumps and wedge cuts.

ABOVE: *The stump notch method works particularly well for cultivating oyster mushrooms. Since the stump no longer has the benefit of the canopy for shade, consider covering the stump with a clear plastic bag to retain moisture.*

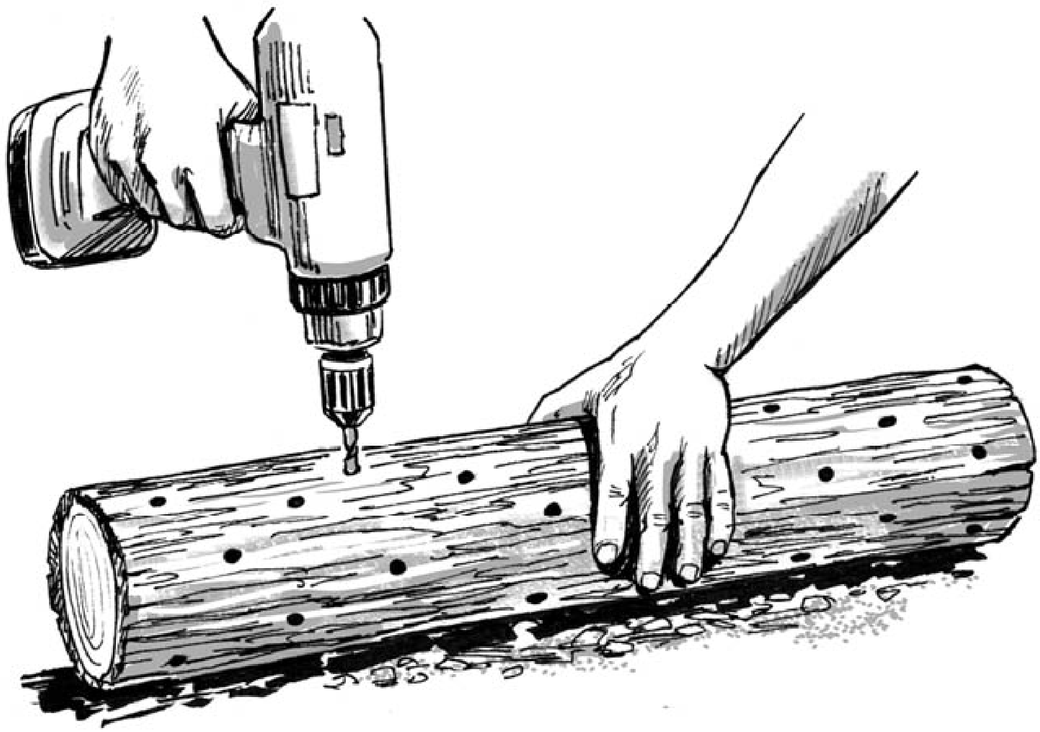
Cultivating Mushrooms on Logs

If you inoculate freshly felled trees, you'll have sufficient moisture content for your spawn. However, if there are more than a few days between felling and inoculating, you'll have to soak the logs overnight before inoculation. Having a quality drill (with a fresh battery) and a sharp ⁵⁄₁₆-inch drill bit is essential for cultivating logs. You'll also need to have your hardwood spawn plugs (nothing more than a wooden plug that has been colonized by mycelium), a mallet, melted wax, and, of course, the logs themselves. The standard length for mushroom log cultivation is 40 inches, and at least 3 to 6 inches in diameter. Working on a bench where you can roll the logs is helpful, as well as a measuring stick marked at 6-inch intervals. The larger the log diameter, the more rows you'll be able to have. Be sure to use healthy, living trees for mushroom cultivation logs. Dead or dying logs will have already been colonized by other fungi, drastically reducing or preventing your fungi from fruiting.

Instructions

1. **Drill the holes.** Begin your drilling pattern 2 inches from the end of the log, with holes spaced every 6 inches, ending 2 inches before the other end. A mark on the drill bit will allow you to consistently drill to the proper depth (approximately half an inch below the bark). Drill the next row 3 inches from the initial row, but offset it by about 1 inch, so that staggering the first hole creates a diamond-

shaped pattern but still maintains a 6-inch offset between plugs in each row. On a 3- to 6-inch log, you'll probably average about four rows. It's a good idea to sterilize the bit with rubbing alcohol between logs, to reduce the chance of pathogenic cross-contamination.



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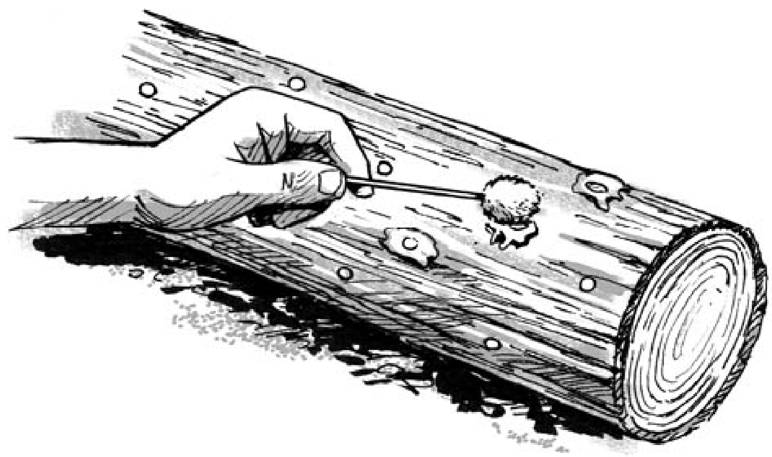
2. **Tap in the plugs.** Once your logs are drilled, tap in the plugs, making sure that they're seated at the bottom of the hole. While you're doing this, you can be warming the wax in preparation for sealing.

3. **Wax the holes.** Wax should be held at a temperature of 150 to 155°F. Dab the wax, sealing entirely around the hole. If the log you're working on has a branch wound, you can coat it with wax to prevent moisture loss. Some people also coat the ends of the log for moisture retention.



EDIBLES, MEDICINALS, AND MISCELLANY

The woodland homestead is also an ideal environment for growing a variety of medicinal plants and minor forest products that simply aren't well suited to open, intense cultivation. Perhaps the most desired woodland crop is ginseng, which is used as medicinal herb to treat a variety of ailments from the common cold to depression. Ginseng has been used in China for over 5,000 years but is also found growing across eastern North America. While ginseng can be cultivated in greenhouses, the most valuable ginseng is wild grown. It can also be wild simulated, a process in which the plant develops slowly, forming large roots with narrow concentric rings similar to the cross-section of a tree.

HOMESTEADER PROFILE

Mushrooms, Ales & Herbs

Tom Huber

Tom Huber practices what he refers to as “hobbit-scale farming”: he keeps his operation intentionally small and focuses on producing goods that he’s able to trade with others. Because he lives in a cold climate (Canton, New York) and is surrounded by vegetable farmers, he’s chosen to produce mushrooms, herbs, and beer, rather than growing vegetables. This homesteading arrangement is largely a recognition that among Tom’s neighbors are the Swartzentruber Amish, who specialize in vegetable production. Other barter arrangements include trading cedar fenceposts for mushroom cultivation logs and herbs for honey. These unique goods from Tom’s forest garden have a high trade value and are well suited to his interests in local ecology and bartering networks.

In addition to maintaining his forest garden, Tom is also an avid forager who’s passionate about sharing his expertise, which is keenly attuned to forest edibles and medicinals. Tom also hopes to promote the ethics of foraging, which include the following:

- Take only what you need, not what you want.
- Share the wealth for the sake of both two- and four-legged friends.
- Take time to study the edibles and medicinals you collect, including how they reproduce and their scarcity and abundance both locally and globally.

GROWING GINSENG

To determine if your wooded homestead is a suitable environment for growing wild-simulated ginseng, employ your woodland eye to help locate indicator species that may tell you if you're standing on a ginseng gold mine. The ideal ginseng growing site has well-drained soils with thick, accumulated organic matter. Conifer sites aren't recommended, because of their low pH and sandy soils. Instead, seek out forests with ferns, Solomon's seal, wild ginger, jack-in-the-pulpit, and spleenwort. Mixed forests with birch, aspen, ash, and maple are also good sites, but these prolific seeders create competition even as they provide needed shade cover.

ABOVE: *When cultivating ginseng, select planting sites with shady north- and east-facing slopes. Seedbeds should be oriented in the same direction as the slope to facilitate drainage.*

Find the right site. Ginseng likes to have moist roots and ample shade. Ideally, you'd want to have about 70 percent crown closure, which refers to the area blocked by the crown as you look up from the proposed ginseng-growing area. Once you've identified what you think is a good site, take the time to dig down and see what the soil below is like. If you're on a maple site, you may be surprised to find that the surface roots form an impenetrable mat, making ginseng cultivation difficult at best. One alternative is to move away from the most heavily rooted area (at the base of the tree) and establish artificial shade using brush to create an arbor that mimics the ideal crown closure.

Prepare the bed. Once you've identified an ideal site, you can begin preparing the seed (or root) bed. Remove any existing herbaceous material that might compete with your ginseng. Dig the planting bed 4 to 5 inches deep and about 4 feet wide, so that you can harvest from each side of the bed. If you're planting multiple beds, leave 2-foot walkways below the rows to facilitate maintenance and harvesting.

Plant seeds or roots. With ginseng you have the option to plant either seeds or roots. While the roots cost more, they are more likely to survive and develop roots relatively quickly. Before planting rootstock, soak the roots for at least 15 minutes to rehydrate them. Some ginseng growers add a fungicide treatment to the soaking solution to reduce the chances of a fungal infection. Roots should be planted about 9 inches apart, with the top of the root about 2 inches below the soil.

If you plant ginseng seeds, you're looking at approximately five to seven years to achieve your first harvest. If you purchase seeds from a mail order company, ask whether they have been stratified. Stratification is the process of pretreating seeds to simulate natural winter conditions necessary for germination. If the seeds aren't prestratified, you'll need to account for the two-month stratification period in your planning. The actual stratification process is simply a matter of placing the seeds in your freezer without disruption, though some growers use a sand-filled stratification box that is buried in the fall to mimic natural stratification.

Mulch well. Once your stratified seeds or roots are planted, it's important to mulch the planting bed as a means of retaining moisture and of fertilizing your seeds beneath. In most cases, 1 to 2 inches of mulch is sufficient for roots, and ½ to 1 inch for seeds. If you live in a particularly cold region of the country, opt for slightly deeper mulch and avoid whole leaves (particularly oak and beech), which can make for an impenetrable mat. Instead, use shredded materials like straw, bark, and sawdust.

Monitor. Over the next few years, you'll want to monitor the site for plant competition and animal damage. Removing seedlings and herbaceous competition by hand is time intensive, but it is usually your only option. Deer will feed on ginseng (as will livestock), so if your crop area is particularly small, it may be feasible to fence off the area.

Harvest. Ginseng is harvested in the fall by carefully pulling the entire plant, much like harvesting carrots. Once it has been harvested and separated from the rest of the plant, wash any remaining soil from the root and place it on a horizontal window screen to dry. Drying should be conducted in a well-ventilated area to prevent mold. This process generally takes several weeks to complete. Dry roots may be stored in a mason jars with holes punched in the lid for ventilation.

Among the most common uses for ginseng is tea, which can be made by mixing ¼ teaspoon dried ginseng root with one quart of boiling water. The result is a spicy and admittedly earthy drink that many folks sweeten with honey.

CHAGA

Inonotus obliquus, commonly known as chaga mushroom, is memorable the first time you see it. Commonly hosted on the trunk of birch trees, the conk has the appearance of a lump of wet charcoal. This growth, however, is not the fruiting body of the fungi but instead a mass of black-pigmented mycelium.

In Siberia, chaga has been used since the 16th century as a nutritional supplement. In China it's regarded as the key to longevity, and is most commonly consumed as a tea. While few clinical trials have been conducted on chaga, it has been proven to contain numerous B vitamins, flavonoids, minerals, phenols, and enzymes.

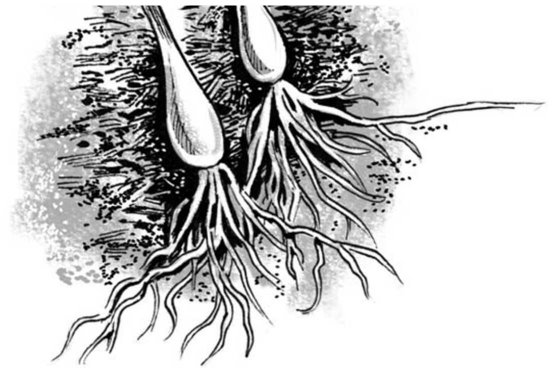
The increased interest in chaga in the United States has created a dilemma for those who try to harvest it sustainably. Because it grows slowly and isn't easily cultivated, experts recommend only taking a small portion of the conk and not harvesting in early spring when the sap is running in the host tree.

To brew chaga tea, simply grind ¼ cup of chaga, steeping it in two quarts boiling water, and then filter the tea to remove the solids.

FIDDLEHEADS AND RAMPS

While a sugarbush is an ideal location to grow wild-simulated ginseng, two other wild edibles are often found nearby: ostrich ferns (*Matteuccia struthiopteris*) and wild leeks, also called ramps (*Allium tricoccum*). Ostrich ferns are often located in the wetter areas of your sugarbush, particularly along drainages and riparian zones. Their curled fronds, known as fiddleheads, are harvested in a very short window of just a few days in early spring. While the fiddlehead fronds grow in clumps, it's important to take just a few from each plant (cut at ground level with a sharp knife) to ensure a sustainable harvest. They are nutritious (with iron, vitamins A and C, and potassium) and have a unique flavor. In terms of preparation, many folks simply opt for sautéing them with a bit of butter and salt; however, it's recommended that you boil the fiddleheads first to avoid gastric upset.

Wild leeks, or ramps, are also found in northern hardwood forests during the spring. Because ramps are sought by gourmet chefs, they are at some risk of being overharvested. Usually, the entire plant (leaves and bulb) is harvested and consumed. An alternative, more sustainable method is to harvest the leaves (which have the same flavor) instead of the bulb. This is believed to be the method that was traditionally used by the Cherokee to avoid overharvesting. You can also dry the leaves and store them for future use.



ABOVE: *Fiddleheads (top) and ramps (bottom) are often found on fertile hardwood sites, making them a common forest crop in sugarbushes and long-abandoned agricultural land.*

BASKETS, BURLS, AND BIRCH BARK

As your woodland eye develops, you'll begin to see all sorts of unique forest products that you might have once dismissed. In many ways, becoming attuned to the potential of your woodlot is a bit like unearthing a treasure trove. As you dig deeper into what you may have thought of as simply "the woods," you will start to see burls as bowls just begging to be turned on a lathe, or strips of bark, ready to be woven into baskets. You may even decide that it makes sense to map your woods, noting the location of unique woodland materials for future use. This perspective stands in sharp contrast to that of an industrial forester, who would view many of the products discussed in this book as "defects."

CREATIVE CULTIVATION

Forest farming is only limited by your own creativity. Many woodland homesteaders have developed uses for unconventional crops. In the Southeast, for example, longleaf pine (*Pinus palustris*) needles are collected as "pine straw" that is used for mulch, groundcover, and animal bedding. Others have found that the boughs of balsam fir (*Abies balsamea*) can rival the value of its wood when sold to wreath makers and floral designers. Even species that are not useful in a conventional sense find new purpose on the woodland homestead. Striped maple, a species that rarely grows larger than a tall shrub, has sinewy bark that can be peeled like a banana and sliced into strips for weaving. What's more, the hollow pith (center) of the striped maple makes it of use as a primitive maple tap, or as a whistle. Be creative, and think outside the forest.

Even if your woodland homestead is small, don't despair; you still have plenty of potential homestead crops, ranging from medicinal plants like jewelweed (great for treating poison ivy rashes), to craft materials like grapevines, forsythia sprigs, and pine boughs. And let's not forget the edibles that can be found in backyards and parks, including all of the nuts mentioned earlier in this chapter, as well as the many edible ornamental plants that populate neighborhoods.

BURLS FOR BOWLS

If you've ever dreamed of making a burlwood bowl, but assumed you couldn't because you don't have a professional wood lathe, think again. In recent years, a variety of new blades have been developed that can be attached to a conventional angle grinder and used to carve beautiful bowls. The following steps will take you from burl to bowl in about eight hours.

Let it dry. Once you've located a burl and cut it from the log, let it dry for at least a year. Attempting to carve a bowl from wet wood will only gum up your tools.

Clamp and carve. For safety, it's important that the burl you're working with is properly clamped. Once it's secure, use an angle grinder with a carving wheel to hollow the burl. Use long, smooth strokes radiating from the center. Take your time and use a pair of calipers to measure and maintain even thickness. Once the center is roughed out, you can use a smaller grinding head to shape the rim of the bowl.

Sand and finish. Once you're happy with the general shape of the bowl, you can begin sanding the inside. Begin with 80-grit sandpaper and work up to 120, 180, and finally 240 grit. Use a wood filler to seal up small crack, or leave them as is for a more rustic appearance. Finish with a polyurethane-based sealant.

ABOVE: *An angle grinder outfitted with a saw chain grinding wheel makes hollowing a burl much faster than if you used a traditional wood chisel.*

EXPERT PROFILE

The Ramp Researcher

Jim Chamberlain, PhD

Jim Chamberlain works for the USDA Forest Service as a forest products researcher in Blacksburg, Virginia. But he doesn't study sawlogs, veneer, or any of the common commercial products that you might associate with national forestlands. Instead, Jim studies wild leeks, or ramps. What began as a simple inquiry into how and where people harvested leeks has evolved into a career that aims to understand both the cultural and ecological aspects of this fascinating plant. And, as interest in harvesting ramps grows, Jim is charged with developing strategies for sustainably cultivating this native edible.

When asked what common mistake novice ramp hunters make, without hesitating Jim says "timing." By timing he means that oftentimes people harvest ramps too early. In the early days of his research, he noticed that many of the ramp festivals in the South were held in April, even though the ramps weren't fully developed until May. This then led him to begin studying the relationship between leaf size and bulb size, a relationship that many homesteaders had anecdotally noticed, and Jim was able to substantiate with empirical data.

Jim's optimistic about the future of ramps as a managed forest crop. Currently he's experimenting with growing ramps in raised beds lined with landscaping fabric as an alternative cultivation method for drier sites.

Although the popularity of foraging for ramps and other woodland crops helps to preserve important cultural knowledge, it can also inadvertently promote overharvesting. For those interested in sustainably harvesting ramps from the wild, Jim offers a simple rule: carefully harvest ramp clumps, but only take one-third and return the other two-thirds (rhizome intact) back to the ground. You can even promote the expansion of your ramp patch by transplanting the remaining two-thirds to a competition-free zone a few feet away.

“When asked what common mistake novice ramp hunters make, without hesitating Jim says ‘timing.’”

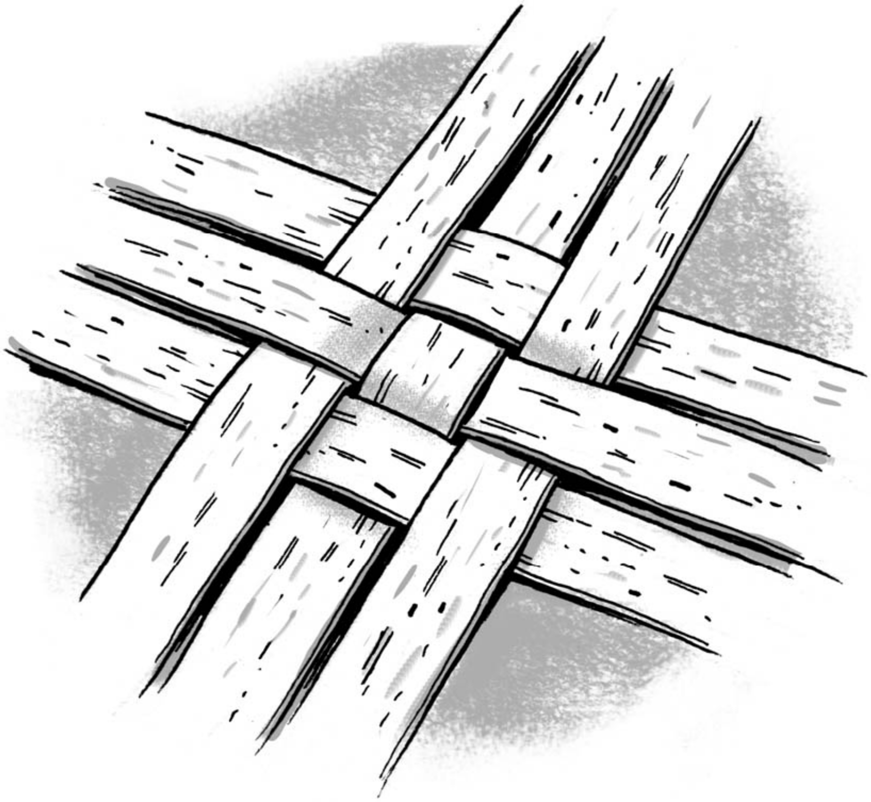
BARK FOR BASKETS

With all the focus on wood, it’d be easy to overlook the benefits of bark. Birch bark in particular has a variety of uses, ranging from the iconic birch bark canoe to simpler products like baskets and rustic wall coverings. While you could theoretically remove birch bark without killing the tree, the health of the tree is ultimately compromised. Instead, it’s best to remove the birch bark using a utility knife after the tree has been felled in late spring. Since the bark of the birch tree decomposes slower than the actual wood, it's often possible to slide an intact sleeve of bark off a partially decomposed log. Below is a simple design for a four-sided birch basket that can be made large or small to suit your needs.

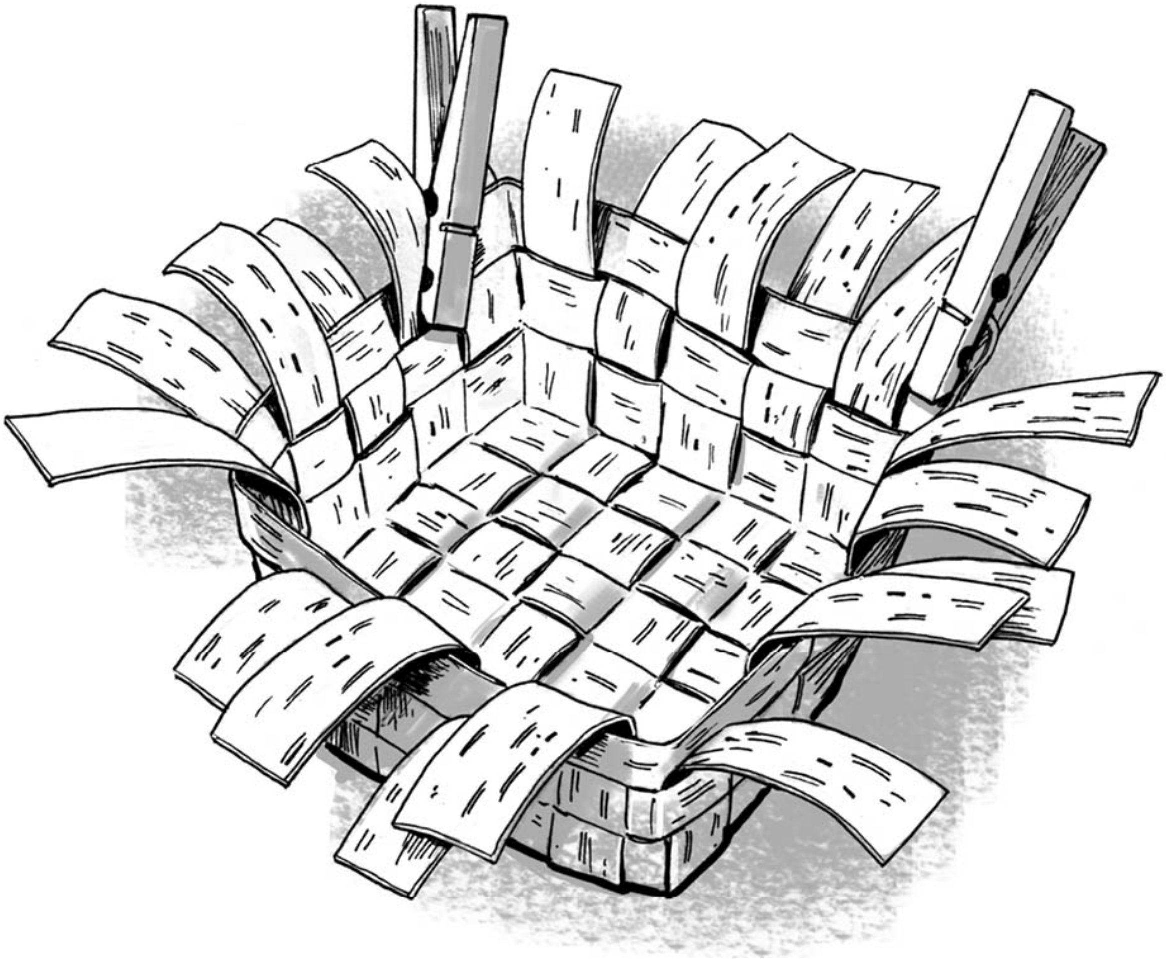
Flatten the bark. Begin by drying and flattening a piece of birch bark; place it between two boards with a heavy weight on top for at least two weeks.

Cut strips. With a board as a guide, use a utility knife to cut strips ¾-inch wide and at least 18 inches long — the longer the strips, the less splicing you'll have to do. If you don't have access to larger pieces of birch bark, don't despair, you can cut your strips using a spiral pattern to make them longer.

Weave the base. Begin by weaving three strips in each direction. Continue weaving strips until you have the desired base size. Once you're happy with the size of the base, place a clothespin at each corner to help hold things together. You can now fold each side of the basket to the edge of your woven base.

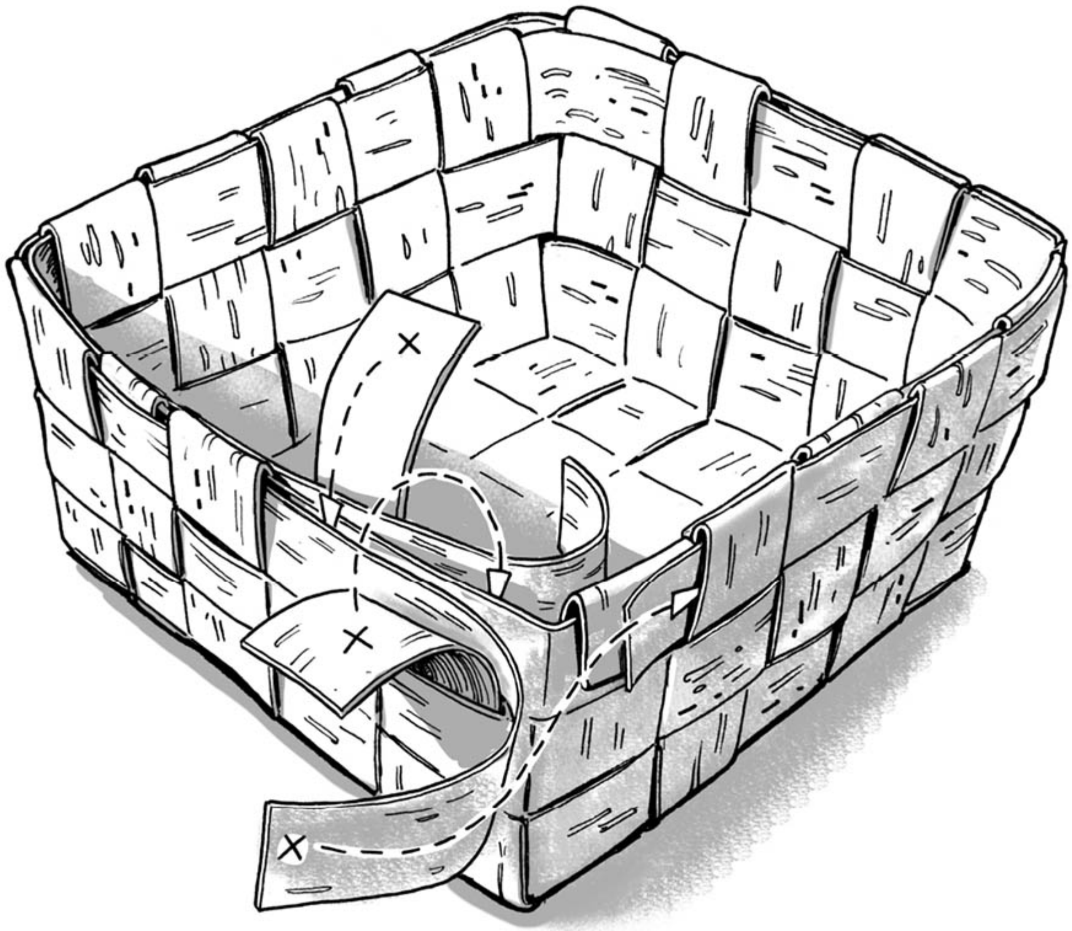


Begin weaving the sides. Additional clothespins are handy for keeping things in check. If your strips are too short, splice in a new piece by overlapping it with the end of the sort piece and tuck under a vertical strip. If a vertical strip is too short, you can splice in a new piece using the same tucking method.



Make the rim. Once you've reached your desired height for the basket, it's time to make the rim. Begin by trimming the vertical edge strips so that they're about an inch higher than the height of the last woven course. Cut two long strips for your inside and outside edges.

Alternate bending the top tabs and weave the inner and outer rim at the same time, but make sure they're offset by one strip when you begin to ensure a tight, strong rim. Tuck the end of the rim pieces on itself and enjoy your new basket.



A Typical Woodland Homestead Calendar

JANUARY

- This is a great month to hunker down by the woodstove and research spring homestead projects.
- For hardy souls, January is also a great time to split wood, giving it ample time to dry before the next heating season.
- Consider logging and skidding wood in winter. If you live in an area with frozen ground, it will prevent soil compaction and minimize disturbance to understory flora.
- Head to the workshop and build rustic furniture with materials harvested from your woodlot the previous season.

FEBRUARY

- Begin preparing for sugaring season by cleaning your equipment and convincing friends and neighbors to swap sugaring labor for a share of the syrup.
- Cut coppice stools.
- Prune fruit trees.

MARCH

- By early March, most folks have begun tapping maple trees. Collect and boil the sap as soon as you're able to, since sap can spoil.
- Inspect beehives for winter mortality.
- March is a good time to frost seed, which encourages successful germination; good sugaring conditions (freezing nights, warm days) make ideal seeding conditions for legumes such as clover.

APRIL

- With leaf-out complete in most areas by late April, this is a good time to begin your woodlot inventory. You can use the new leaves (instead of just the buds) to help identify the trees in your woodlot before summer, when undergrowth becomes dense enough to make the process difficult.
- Put your pigs to work in a pig-o-tiller as soon as the ground begins to dry out; pigs will be ready to harvest in November.
- Plant spring fruit trees.

MAY

- Birch-tapping season begins in late April/early May.
- Attend Memorial Day barn and yard sales, a great way to find old tools and homesteading accoutrements.
- Livestock begin browsing on nutrient-dense, early-season growth.
- Harvest willow for furniture construction.

JUNE

- Inspect and repair fences.
- Harvest wild strawberries.
- Tend woodlot, thinning trees for optimal growing space.

JULY

- Rapid pasture growth makes this a highly productive month for mob-grazing livestock.
- Enjoy eating fresh fruits and vegetables out of your woodland garden.

AUGUST

- Practice intensive rotational grazing.
- Collect and preserve wild berries.
- Build hügelkultur beds.

SEPTEMBER

- Harvest fall honey (be sure to leave some for the bees).
- Harvest nuts.
- Begin harvesting and cellaring fruits and vegetables for winter storage.

OCTOBER

- Host a cidermaking party on the full moon.
- Attend a livestock auction; if you have winter forage, this can be a great way to acquire livestock (small and large) at reasonable prices as other homesteaders and farmers downsize for winter.
- Make firewood windbreaks for around the house.

NOVEMBER

- Add fuel stabilizer to all power equipment to prevent fuel from gelling over the winter.
- Begin cutting and laying hedge as a living fence.
- Cool days make this an ideal time of year to fire up your charcoal kiln.

DECEMBER

- Experiment with animal power and keep your dogs/horses/oxen in shape by having them pull a sled.
- If local ordinances permit, this is a great time to burn brush (if there's snow cover). If your garden soils are acidic (pH 4.6–6.0), consider placing your brush pile over your garden; the wood ash will work as a liming agent, raising pH. However, before you do this, you'll want to check your soil pH to see if a higher pH is necessary to grow your desired crops.

- Repair any broken tools; sharpen saws/axes; organize your tool shed.

Resources

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Seeing the Forest through the Trees: How to Unlock Your Woodlot's Potential

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Woodland Structures: From Living Fence to Living Barn

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Chapter 6:
Giving Trees: Fruit, Honey, and Syrup

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