



AGRICULTURAL ALTERNATIVES

Managing Small Woodlots

As a woodlot owner, you may have thought from time to time about the future of your woodland and what you might do to improve its condition and value. Most Pennsylvania woodland owners use their property for recreation, a place to hunt and view wildlife, or as a family legacy to pass on to the next generation. Sometimes, though, woodland owners want or need to harvest trees from their woods. This is a time when you can improve your woods for the future or cause real damage from which it might not recover for generations.

This publication will help you understand how forests grow, provide steps to plan for their management, and describe how to market and sell trees. You should consider your decisions carefully and seek assistance from a professional forester who will represent your interests during the selling and harvesting process. The investments you make at this point can pay great dividends in the future health and productivity of your woodlot.

Pennsylvania's Forests Today

Forests cover more than 17 million acres in Pennsylvania, representing about 60 percent of the state's land area. Private landowners own about 70 percent of the forestland (12 million acres). County, state, and federal governments control much of the remaining forests (4.5 million acres, 23 percent). The forest products industry—once a significant landowner—holds less than one million acres of Pennsylvania's forestland. Now, timber investment management organizations and real estate investment trusts own and manage large forested tracts in the state.



Forests are important to Pennsylvania's economy. The forest products industry is the fourth-largest manufacturing segment in the state, employing about 100,000 people and having an economic impact of nearly \$20 billion annually. Pennsylvania is the nation's largest producer of hardwood lumber with over one billion board feet, enough to build more than 60,000 2,000-square-foot houses per year. Forests are also the source of millions of days of recreation that contribute an additional \$10 billion to \$12 billion to the state's economy. Beyond their economic benefits, forests contribute to our quality of life by providing clean air and water, aesthetic views, stormwater control, and wildlife habitat.

Because private forests are a dominant land ownership class, the decisions made by the estimated 740,000 private owners of one or more acres have a major impact on the economic, social, and ecological health of the state. Over time, forest ownership has changed toward a tendency to divide holdings into increasingly smaller parcels as they change hands. This process, called parcelization, is a major threat to many of the values associated with forests.

Forest History and Current Condition

Timber production has been a part of Pennsylvania's economic history since the first Europeans arrived. The first sawmill was established by Swedish settlers in Philadelphia in 1662. When Pennsylvania was given to William Penn by Charles II of England in 1681, about 90 percent of the province was covered by forests. At that time, Penn recommended that "care be taken to leave one acre of trees for every five acres cleared." During the next 200 years large tracts of land were cleared to provide land for farming, lumber for building, and the raw materials for various manufacturing enterprises.

At the peak of land clearing in the 1890s, about two-thirds of the state was cleared. From the late 1880s through the 1920s, clearing forestland provided essential farmland and met the nation's appetite for wood. During this period of forest exploitation, the area of forestland in Pennsylvania was reduced to less than 11 million acres. At the end of this period, forest-dependent industries such as leather tanning, wood chemical manufacturing, charcoaling, and sawmilling collapsed, and economic conditions led to farmland abandonment. Forests then began the slow process of recovery.

Today, Pennsylvania's forests contain world-class oak, maple, and cherry. Gone are the extensive forests of white pine, hemlock, and American chestnut, which were either harvested or taken by disease. Forest inventories conducted by the U.S. Forest Service suggest that we have more timber volume growing in the state today than we have had in over 100 years, and we continue to grow more than twice the volume that is harvested annually.

However, not all is good in the forest. Data suggest that about half of the forests in the state are in poor condition, unable to regenerate with desirable tree species. Insects, diseases, and improper harvesting practices are changing the mix of trees in our forests. Less desirable tree species such as red maple, black birch, and black gum are more common. Oak trees are much less common. Competing native plants such as ferns, spicebush, and mountain laurel are also increasing in forest understories. Invasive exotic plants are crowding out native trees and plants. Introduced invasive insects are severely reducing the abundance of certain desirable tree species. Poorly executed harvesting practices, known as high grading, are shifting species composition, removing desirable seed sources, leaving poorer quality trees, and generally reducing forest economic and ecological values. Carefully applied science-based forestry practices are needed to restore forest health and provide future value for those who will own and manage our forests in the future.

Managing Your Small Woodlot

The most important thing to consider as a woodland owner is how you value your woods. Specifically, how do you currently use your woodlot, what kinds of things do you value most

(recreation, income potential, etc.), and what would you like to have for retirement or for the next generation?

Consider this question: How do you use your woods? Many people think about their woodland primarily as a recreational resource. Woodlots are a place to hunt, walk, or get away. You may also consider it part of your legacy, something to pass on to the next generation. When asked to rank the values they attach to woodland, few people rank timber or the economic value of trees as very important. A Penn State study asked landowners about the economic value of their woodland. Unexpectedly, they had a reasonable idea of the value of the timber, but they were less informed about the best way to manage their property for different uses. Increasingly, land managers are finding that woodlots have already been cut over, are in poor condition, and are unlikely to continue to pay reliable dividends without some management.

So, what do you value? Do you want to cash in on your trees from time to time? This can increase your woodlot's future value if it is done with attention to sustainability and proper forest management practices. Do you value hunting, seeing big bucks, or harvesting a turkey? Cutting timber will affect wildlife habitat, increasing resources for some species while potentially decreasing it for others. It is important to carefully think about your objectives and consider how management practices might change the things you value.

The Dynamic Forest

Forests change on their own every day in small and cumulative ways. Eventually, you become aware of these changes. A basic understanding of forest processes depends on a working knowledge of ecology. This helps us understand how forests change and how management decisions affect forest values.

Trees and all plants require water, nutrients, light, and space to grow. Every tree requires space to ensure that it can capture enough light, water, and nutrients. Forest management involves controlling the space around trees, so they can retain or increase their crowns (leaf surface) and grow. Without proper management, "decisions" about how trees compete for growth resources are left entirely to natural competition.

Management Planning

Careful planning is required to increase the value of your woodlot. Writing a management plan will help you consider what you value about your woods and what you hope to achieve. It provides a schedule of activities to help you achieve your vision. Many woodland owners find they benefit from involving their family in these discussions and working with a forester who can translate their objectives into actions. The management plan should involve everyone concerned with the current operation and consider future generations. If you plan to sell timber, a professional forester who understands your vision and works for you will ensure you market your timber effectively while conserving the kinds of things you value. Many studies have concluded that landowners who involve a professional forester are more

fully satisfied with the outcome of timber sales and consistently receive higher prices.

Steps of the Management Plan

1. Determine both your short- and long-term objectives. What do you want from your woodlot?
2. Assess the physical and biological characteristics of your woodland. What do you have? Can this land meet your objectives? If not, what options do you have?
3. Develop a written plan, which includes descriptions, recommendations, a map, and a time table for scheduling specific activities.
4. Follow the schedule of activities to ensure that you achieve your objectives.

Evaluating Your Woodlot

Before any activities take place, you should be certain about your property boundaries. An accurate survey may be necessary. Your deed contains a written description of your boundary corners and is available from your county courthouse. An aerial photograph from your local Farm Services Agency office with the property boundaries is also helpful. A topographic map is useful for showing elevation changes, streams, and other landmarks. A soils map from your local conservation district will provide information for determining what tree species may be on your property.

There are two primary forest types in Pennsylvania, oak/hickory (about 47 percent of forested land) and northern hardwoods (about 40 percent of forested land). The oak/hickory type occurs on many soil types and includes red, black, and white oaks. Poorer growing sites in this type will also include scarlet oak and chestnut oak. Red maple, black birch, hickory, ash, black gum, and white pine are also commonly found growing in this forest type. The northern hardwoods forest type is commonly associated with the Allegheny Plateau and lower and northern-facing slopes in the central part of the state. Tree species include sugar maple, beech, yellow birch, black cherry, ash, yellow poplar, and red maple.

Tree species, quality, board foot volume, accessibility, and distance to markets all contribute to the value of the trees in your woodlot. Quality has a major impact on the value of your trees and is determined by log diameter and length, presence of surface and internal defects, growing site (soil types), and species. Logically, proximity to mills and markets affects price; however, this is less of a problem if you have enough volume of high-quality logs.

Many factors can affect the price buyers are willing to pay for your timber. Site conditions—such as well-drained soils, for example—will permit logging during wet periods and could potentially increase the value. Very steep areas that make road building or log skidding difficult may lower prices offered, as will flat sites with poor drainage. Proximity to water and stream crossings can increase logging costs. The volume of trees per acre, shape of the sale area, distance to roads and mills, time of year, owner-imposed restrictions on

cutting, equipment needs, and myriad other factors all affect the price offered.

Saw and veneer logs are bought and sold based on their board foot volume (a board foot is a piece of wood that is 1 foot by 1 foot by 1 inch thick) and grade. Three log rules are used in Pennsylvania for determining the number of board feet in a tree: International, Scribner, and Doyle. You should always know which log rule a buyer is using to ensure you understand the price offered. As shown in Table 1, below, the volume estimate for smaller logs varies considerably depending on the log rule used. Measurements are made with a DBH (diameter at breast height) tape measure, which measures the circumference of the tree and calculates the diameter. You can purchase a DBH tape measure from a forestry supply company.

Timber Marketing

If your management plan recommends selling timber, approach the market thoughtfully. Selling timber is often a once-in-a-lifetime event that will have long-term impacts on your woodland and what it provides to you and your family today and tomorrow. A good source for regional timber prices is the “Pennsylvania Timber Market Report,” which is produced quarterly. It is available from your local extension office or online at extension.psu.edu/timber-market-report. To help ensure the best possible outcome, be sure to consider price, forest health, and future productivity. In addition, consider hiring a professional consulting forester to work on your behalf.

Consulting foresters will charge a fee, which may be on a lump-sum basis, a percentage of the sale price, an hourly rate, or on units of work completed. Your consulting forester will mark the trees to be cut, determine the value of the marked trees, assist with the bid and contract process, and inspect the

Table 1. Comparison of board foot volume estimates from commonly used log rules for 16-foot logs in standing trees.*

| Tree DBH (inches) | Log Rule | | |
|-------------------|----------------------|-----------------------|-------|
| | International ¼-Inch | Scribner (board feet) | Doyle |
| 10 | 36 | 28 | 14 |
| 12 | 56 | 47 | 29 |
| 14 | 78 | 69 | 48 |
| 16 | 106 | 95 | 72 |
| 18 | 136 | 123 | 100 |
| 20 | 171 | 157 | 135 |
| 22 | 211 | 194 | 174 |
| 24 | 251 | 234 | 216 |
| 26 | 299 | 281 | 266 |
| 28 | 347 | 327 | 317 |
| 30 | 403 | 382 | 376 |

Source: Daniel Cassens, “Log and Tree Scaling Techniques” (West Lafayette: Purdue University Cooperative Extension, 2001), www.extension.purdue.edu/extmedia/FNR/FNR-191.pdf.

woodland during logging. Fees charged by your consultant are an expense associated with the timber sale and can be deducted from the gross income, reducing your tax liability. To learn more about this, visit the National Timber Tax website at www.timbertax.org.

Your professional consulting forester has two primary obligations:

1. Help you get the best price for your timber
2. Perform the harvest in a sustainable manner, preserving future management options

To do this, your forester will:

1. Negotiate a contract with you that covers their responsibilities in preparing and administering the timber sale
2. Determine the volume, quality, and approximate value of the standing timber
3. Devise a plan to conduct the harvest procedure
4. Develop an erosion and sedimentation plan
5. Notify potential buyers of the impending sale and solicit bids
6. Negotiate a contract on your behalf
7. Collect and hold any completion bonds
8. Inspect the harvest operation frequently
9. Conduct a postharvest follow-up before closing the contract and releasing the bond

In preparation for a timber sale your forester will prepare a bid notice. This is used to solicit bids from potential buyers. They will also know which buyers are reputable and can help you receive the best possible price and harvesting outcome that protects your future investments.

You should also consult with legal counsel during the contracting process when selling timber. Have your lawyer review the contract when you hire your forester and the resulting contract for the timber sale. These added steps may save you time and money in the future. Contracts should include all the details relating to the sale, logging, and any follow-up work for which the buyer is responsible before closing the operation.

After the logging and follow-up are complete, inspect the woodlot with your forester to determine if all requirements have been fulfilled. Are there any roads to grade? Are there any places requiring stabilization to prevent erosion? Did the loggers remove or significantly damage any unmarked trees? All such questions need to be answered prior to the final settlement of the contract.

Sawtimber

Selling sawtimber, including veneer, provides the highest economic return from your woods. The market for sawlogs has been quite volatile in recent years with changing economic conditions. Knowing exactly what you want to sell is an essential part of a marketing plan. Your forester will assist you in this process by reviewing your management plan and implementing proper forest management practices to help you

Table 2. Minimum size requirements for hardwood tree grades.

| Log Grade | Log Diameter at Breast Height (at 4.5 Feet) | Log Diameter Top of Butt Log (at 17 Feet) |
|-----------|---|---|
| Grade 3 | 10 | 8 |
| Grade 2 | 13 | 12 |
| Grade 1 | 16 | 13 |
| Veneer | 18 | 15 |

achieve your management objectives. The forester will measure and mark trees for removal. As a rule of thumb, you will need at least 20,000 to 50,000 board feet of timber to attract quality buyers.

Marketable sawtimber trees will measure at least 12 inches DBH and have at least one 16-foot log before any major branching or forks. In the marking process, trees designated to be cut should be marked with paint at DBH and on the stump. Doing this ensures the correct trees will be harvested.

The quality of your trees or timber has a dramatic impact on the income you can realize from the sale. Tree (or log) grades relate directly to lumber grades and greatly influence the price you will receive. Generally accepted tree grades are grade 3 (low quality), grade 2 (medium quality), grade 1 (high quality), and veneer (the highest quality). Tree grades project the yield of clear wood (free of knots or defects) within the butt log portion of the tree.

Several factors affect tree grade. These include straightness, size (see Table 2, above), and spacing and number of defects such as holes, knots, and splits. The grading rules for veneer are very specific. Veneer trees must be at least 18 inches DBH with no exterior defects in the butt log. Red oak, white oak, and black cherry are our primary veneer species. Markets for veneer are seasonal and vary by location.

Pulpwood

Pulpwood refers to trees used to make paper. Pennsylvania has few markets for hardwood and softwood trees used for pulp since the paper industry has declined in recent years. Most pulpwood comes from trees between 4 and 12 inches DBH with a maximum of 20 inches DBH. Pulpwood harvesting is typically part of an integrated sale, which also involves cutting sawtimber. A well-planned, integrated sale will focus on leaving the best growing and most desirable trees while removing poorer quality and less desirable tree species. The amount of wood removed in a typical pulpwood sale might be 15 to 30 tons per acre, with hardwoods selling for \$1.50 to \$3.00 per ton and softwoods for \$3.00 to \$6.00 per ton. Clearly, the income generated from pulpwood harvesting is not large, but if done correctly, it can greatly improve forest health and growth.

Fuelwood

Fuelwood or firewood cutting is one of the lowest-value crops you can take from your woods. Done carefully as part of a thinning operation where cutting provides growing space

for the remaining trees, it will improve your woodlot. You may sell firewood from standing trees or tops left on site or deliver it to the consumer cut and split. Selling firewood from standing trees involves the least amount of effort, but it also yields the lowest income. If you do not have experience felling, skidding, and processing trees, this is the safest option. In Pennsylvania, firewood is sold by the cord (or fraction of a cord), which is a stack of wood 4 feet by 4 feet by 8 feet (approximately 128 cubic feet). Standing trees sold for firewood may sell for between \$10 and \$25 per cord depending on species and your location. If you have not previously removed trees from your woodlot, the first thinning may yield 3 to 8 cords per acre.

If you choose to cut, split, haul, and stack the firewood, you will need the proper equipment. This equipment may include a chainsaw, safety equipment (i.e., safety chaps, helmet, face shield, ear protection, and safety shoes), wedges, a splitting maul or mechanical splitter, a tractor, and a pickup truck or trailer. A cord of wood split, delivered, and stacked may sell for \$150 to \$200 (and sometimes more) depending on species, location, alternative energy prices, and demand.

Silviculture Practices

Silviculture is the theory (science) and practice (art) of controlling forest establishment, composition, structure, and growth. Establishment involves either planting or naturally regenerating the next tree crop. Composition involves matching tree species to the site and management objectives. Structure reflects the arrangement of trees in and below the main canopy. Growth addresses how trees receive site resources (i.e., light, moisture, nutrients, and space). A forester who understands your management objectives will use silvicultural practices to help you meet your short- and long-term goals.

Silvicultural treatments promote the growth of the most desirable tree species—trees that will meet your objectives. This normally requires cutting trees that are competing for light and space with the trees you want to grow. Allowing nature to “decide” which trees to remove will not necessarily result in a healthy or productive woodlot and may not meet your objectives in the long run.

Because of the past cutting history in Pennsylvania, many of our woodlots contain trees that are roughly the same age, approximately 100 to 120 years old, referred to as even-aged. This means that the trees comprising the upper canopy all started growing at roughly the same time. This is often a difficult concept to grasp as individual tree diameters can vary greatly in any given woodlot. In even-aged woods, thinning is the primary silvicultural tool for improving the woodlot. A thinning removes the least desirable trees and allows room for the more desirable trees to reach their full potential.

An example of a silvicultural thinning that removed trees from the lower- and middle-diameter classes is shown in Table 3, above. Thinning retains the larger trees and cuts trees that are in competition with one another. In this example, the average tree diameter of the stand before the cut was 11.7 inches. After the cut it was 12.4 inches, with the harvest focusing on cutting the smaller, less valuable trees. By cutting this

Table 3. Example of the distribution of trees by diameter class before and after a thinning cut in a 70-year-old, even-aged oak/hickory woodlot.

| DBH* Class (inches) | Trees per Acre | | |
|---------------------|----------------------------|---------------------------|---------------------|
| | Number of Trees Before Cut | Number of Trees after Cut | Number of Trees Cut |
| 4 | 12 | 12 | 0 |
| 6 | 24 | 8 | 16 |
| 8 | 12 | 2 | 10 |
| 10 | 24 | 10 | 14 |
| 12 | 30 | 10 | 20 |
| 14 | 36 | 30 | 6 |
| 16 | 20 | 14 | 6 |
| 18 | 12 | 6 | 6 |
| 20 | 2 | 2 | 0 |
| 22 | 4 | 4 | 0 |
| Total | 176 | 98 | 78 |
| Average DBH | 11.7 | 12.4 | 10.8 |

*DBH = diameter measured at breast height, 4.5 feet above the ground.

way, you keep the fastest growing trees, shorten the time to the next cut, and redistribute growth to the more valuable trees. This example represents harvest from one acre of hardwoods following a typical prescription thinning that focuses on removing the smaller diameter classes and retaining larger trees. While this does not provide the highest immediate return, it will yield higher returns in the long term.

Crown Classes

Because trees compete with one another for light, moisture, and nutrients, your management plan should focus on redistributing light to those trees that meet your objectives and respond with increased growth. In even-aged woods, understanding how trees compete in the forest canopy is important. Knowing where individual tree crowns are in the canopy and how they will respond to increased light is essential when implementing a thinning.

The crown is the uppermost part of the tree. It contains the smaller limbs and leaves that collect sunlight and enable the tree to carry on photosynthesis. Crowns are referred to as being in one of four classes: dominate, codominant, intermediate, and suppressed. Dominate crowns are the largest in the forest. They receive sunlight from the top and some from all sides. Usually, when you look up, they are fully round. Codominant crowns receive full sunlight from the top and very little to no sunlight from the sides. These crowns are often flattened on one or more sides where they compete with other codominant crowns. Codominant crowns make up the main level of the forest canopy. Intermediate crowns are shorter but extend into the upper canopy of the forest. They receive limited sunlight from the top and no sunlight from the sides.

Suppressed crowns are the smallest trees and receive no direct sunlight from any angle; they are completely overtopped.

Thinning harvests seek to improve conditions for codominant trees by removing competition and encouraging them to develop fuller, more balanced crowns. Depending on the species, trees with intermediate crowns may also respond to thinning. Tree species that are tolerant of shade, such as hemlock and sugar maple, will increase their crown size with more sun. Trees that are less tolerant of shade, such as red and white oak, may increase crown size, but the percentage of crown relative to the total height and its overall health needs to be evaluated.

The important point when conducting a thinning is to avoid diameter- or species-driven cutting decisions. Leave trees to improve the overall diversity, quality, and health of the woodlot. If you select trees for harvest based only on size or species (for example, all the red and white oak), this is termed high grading. Tree DBH does not represent age well. Harvests designed to cut just big trees to release smaller diameter trees are poorly designed and will remove the best trees and leave only weak, suppressed trees. High grading will greatly reduce overall productivity and future income potential, and greatly extend the time it takes to grow large, high-quality trees.

After one or two thinnings in an even-aged woodlot, you will have to consider when to regenerate. If you have managed your thinning operations and the impact of deer browsing well, you should have tree seedlings and saplings already in place under the large overstory trees. Work with your forester and have them advise you on when to do the final overstory harvest, releasing the next forest.

Crop Trees

Crop trees are the trees you wish to retain and grow into the future and that have the potential to produce the benefits you desire and meet your objectives for ownership. Selecting and marking crop trees allows you to focus on the trees you want to keep. It also allows you to more easily decide which trees need to be cut because they are competing for light and growing space with your crop trees. Crop trees should be desirable species, with healthy dominant and codominant crowns and defect-free trunks with good form. Avoid selecting crop trees with weak crowns or obvious defects. Crop trees should be evenly spaced when the trees mature, no closer than 20 to 30 feet apart. This is a general guideline; sometimes trees will be closer together. Always look up and consider how you can remove competition and help balance or round out the crowns. Providing room for the crop tree to grow and expand its crown is your objective.

Conclusion

A properly managed woodlot can be viewed as a valuable savings account. Making sure it provides income when you need it involves having an up-to-date management plan and working with a professional forester. Well-managed woodlots rep-

resent a commitment to proper stewardship. It takes four or five generations to grow high-quality timber in Pennsylvania. One or two poorly planned and implemented harvests can destroy that woodlot for generations to come.

Sample Budget

Following are three tables that will help you predict future income from your timber. The income from your woodlot could come from a thinning harvest (like that shown in Table 3) or a more extensive harvest. Working with a consulting forester before making any decisions about timber harvesting is highly recommended.

Estimating the returns from a woodlot is complicated because of the wide variety of tree species, grades, and sizes. You can use the harvest size and price examples in Tables 4 through 6 as guides for developing your own projections in the accompanying “Your Estimate” tables.

The assumption in these examples is that all trees were scaled as containing only one 16-foot log. While this is not likely the case, it allows for using the volumes provided in Table 1 for standing tree volumes. To find volumes for other log lengths, refer to “Log and Tree Scaling Techniques” at www.extension.purdue.edu/extmedia/FNR/FNR-191.pdf. The board foot estimates in Table 4 are based on measurements using the International ¼-Inch log rule. You will need to calculate the number of board feet for each tree species you plan to harvest. A range of sawmill prices for various tree species can be found in Table 5. Average prices can vary considerably from region to region and represent differences in market demand and tree size and quality. Consult the most recent version of the “Pennsylvania Timber Report” (extension.psu.edu/timber-market-report) for the latest prices. Table 6 contains an example for the harvest of 100 trees using average statewide prices. You can use the “Your estimated value of a timber harvest from your woodlot” table to summarize the number of trees you plan to harvest, the estimated number of board feet (from Table 4), and the price you expect to receive (based on similar data in Table 5). The value of any fuelwood or pulpwood sales are not included in the examples.

For More Information

Publications

- Becker, J. C., L. F. Kime, J. K. Harper, and R. Pifer. “Agricultural Alternatives: Understanding Agricultural Liability.” University Park: Penn State Extension, 2011.
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- Hilts, S., and P. Mitchel. *The Woodlot Management Handbook: Making the Most of Your Wooded Property for Conservation, Income, or Both*. Richmond Hill, ON: Firefly Books, 2009.
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Diversity. 2nd ed. Upper Saddle River, NJ: Prentice Hall, 2010.

Morsbach, H. *Common Sense Forestry*. White River Junction, VT: Chelsea Green Publishing, 2002.

Wagner, J. E. *Forestry Economics: A Managerial Approach*. Florence, KY: Taylor and Francis, 2011.

Walsh, A., and K. C. Waldron. *Forestry A–Z*. Custer, WA: Orca Book Publishers, 2008.

Online Resources

Penn State Extension Publications on Private Forests
extension.psu.edu/forests-and-wildlife

Pennsylvania Department of Conservation and Natural Resources Bureau of Forestry
www.dcnr.pa.gov/about/Pages/Forestry.aspx

Pennsylvania Sustainable Forestry Initiative
www.sfiopa.org

United States Forest Service
www.fs.fed.us

Table 4. Example for calculating board feet for lumber.*

| Tree Size (DBH) | Number of Trees Harvested | Board Feet per Tree** | Total Board Feet |
|-----------------|---------------------------|-----------------------|------------------|
| 10 | 1 | 36 | 36 |
| 12 | 3 | 56 | 168 |
| 14 | 4 | 78 | 312 |
| 16 | 2 | 106 | 212 |
| 18 | 1 | 136 | 136 |
| 20 | 1 | 171 | 171 |
| 22 | 0 | 211 | 0 |
| 24 | 1 | 251 | 251 |
| 26 | 1 | 299 | 299 |
| 28 | 1 | 347 | 347 |
| 30 | 0 | 403 | 0 |
| Total | 15 | | 1,932 |

*For trees 10 inches and larger with a log height of 16 feet. Measured using the International ¼-inch log rule.

**This example assumes using the International ¼-Inch log rule. For your calculations, use the International, Scribner, or Doyle values from Table 1.

Source: Richard G. Oderwald and James E. Johnson, “Measuring Standing Trees and Logs” (Blacksburg: Virginia Cooperative Extension, 2009), <http://pubs.ext.vt.edu/420/420-560/420-560.html>.

Your estimate of the number of board feet of lumber for a single tree species in your woodlot.

| Tree Size (DBH) | Number of Trees | Board Feet per Tree | Total Board Feet |
|-----------------|-----------------|---------------------|------------------|
| 10 | | | |
| 12 | | | |
| 14 | | | |
| 16 | | | |
| 18 | | | |
| 20 | | | |
| 22 | | | |
| 24 | | | |
| 26 | | | |
| 28 | | | |
| 30 | | | |
| Total | | | |

Note: Use this table to calculate the number of board feet of lumber for each tree species you plan to sell within your woodlot.

Table 5. Average prices by species and regions within Pennsylvania based on the Pennsylvania “Timber Market Reports” (2013–2018). Also listed are the highest and lowest values per species in those six years.

| Tree Species | Northeast | Northwest | Southeast | Southwest | Statewide Average | Lowest Value | Highest Value |
|------------------|-----------|-----------|-----------|-----------|-------------------|--------------|---------------|
| Black Cherry | \$775 | \$730 | \$465 | \$340 | \$578 | \$206 | \$1,131 |
| Hard Maple | \$360 | \$355 | \$360 | \$290 | \$341 | \$201 | \$546 |
| Hemlock | \$60 | \$45 | \$65 | \$85 | \$64 | \$21 | \$152 |
| Misc. Hardwoods | \$110 | \$75 | \$190 | \$100 | \$119 | \$27 | \$283 |
| Mixed Oak | \$310 | \$270 | \$390 | \$300 | \$318 | \$141 | \$506 |
| Northern Red Oak | \$460 | \$455 | \$525 | \$415 | \$464 | \$319 | \$676 |
| Soft Maple | \$250 | \$255 | \$205 | \$215 | \$231 | \$169 | \$307 |
| White Ash | \$295 | \$260 | \$260 | \$175 | \$247 | \$50 | \$374 |
| White Oak | \$350 | \$350 | \$430 | \$370 | \$375 | \$198 | \$520 |
| White Pine | \$80 | \$45 | \$100 | \$100 | \$81 | \$17 | \$196 |
| Yellow Poplar | \$240 | \$140 | \$310 | \$190 | \$220 | \$87 | \$392 |

Table 6. Example of estimating the timber value of the harvest of 100 trees from a woodlot.

| Tree Species | Trees Harvested* | Average Price per 1,000 Board Feet** | 1,000 Board Feet*** | Projected Timber Value |
|------------------|------------------|--------------------------------------|---------------------|------------------------|
| Black Cherry | 11 | \$580 | 1.2 | \$696 |
| Hard Maple | 7 | \$340 | 0.7 | \$238 |
| Hemlock | 5 | \$65 | 0.5 | \$33 |
| Misc. Hardwoods | 12 | \$120 | 1.3 | \$156 |
| Mixed Oak | 8 | \$320 | 0.8 | \$256 |
| Northern Red Oak | 13 | \$465 | 1.4 | \$651 |
| Soft Maple | 15 | \$230 | 1.9 | \$437 |
| White Ash | 5 | \$250 | 0.5 | \$125 |
| White Oak | 13 | \$375 | 1.4 | \$525 |
| White Pine | 4 | \$80 | 0.4 | \$32 |
| Yellow Poplar | 7 | \$220 | 0.7 | \$154 |
| Total | 100 | | 10.8 | \$3,303 |

*Example based on the estimated number of trees harvested per species from percentages listed in the "Pennsylvania Forest Inventory Analysis," 2016 data.

**Prices based on a six-year average (2013–2018) of values from the Pennsylvania "Timber Market Report."

***Based on one 16-foot, 16-inch DBH log using the International ¼-Inch log rule, rounded to the nearest 100 board feet. For an example of estimating the board feet of standing timber, see Table 4.

Your estimated value of a timber harvest from your woodlot.

| Tree Species | Trees Harvested | Average Price per 1,000 Board Feet | 1,000 Board Feet | Projected Timber Value |
|------------------|-----------------|------------------------------------|------------------|------------------------|
| Black Cherry | | | | |
| Hard Maple | | | | |
| Hemlock | | | | |
| Misc. Hardwoods | | | | |
| Mixed Oak | | | | |
| Northern Red Oak | | | | |
| Soft Maple | | | | |
| White Ash | | | | |
| White Oak | | | | |
| White Pine | | | | |
| Yellow Poplar | | | | |
| Other | | | | |
| Other | | | | |
| Other | | | | |
| Other | | | | |
| Other | | | | |
| Total | | | | |

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