

# Measuring the Range of Forest Values

By Fred Sperry and James A. Mehrwein

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Picture this scenario: Doug and Lizzy Menziesii realized their dream when they purchased 40 acres in southwest Washington. Besides the home site and pasture, the property had 35 acres of moderately-well stocked, 20-year-old Douglas-fir. Over the years, with the help of Lizzy and the kids, Doug has cut brush, done a little precommercial thinning, and even sold 20 log truck loads of thinning logs.

Now, 30 years later, it seems everyone wants his logs. (Indulge us here and let's pretend that we actually have a decent log market.) One log buyer wants to buy the timber for a lump sum, one wants to pay a per thousand board foot stumpage rate as the logs are delivered, and two more give Doug prices for logs delivered to their mill. One logger offers to log the timber for a fixed rate per thousand board feet, another on a rate per ton, and yet another offers to log it for a percentage of the log sales price.

What information does Doug need to determine the best offer? Does he need an inventory or a timber cruise?

Here's a second scenario: Jason Alder recently purchased 160 acres in the Willamette Valley of Oregon. The property has a mixed stand of merchantable maple, alder and Douglas-fir, some Douglas-fir reprod, and some oak woodland with Douglas-fir and grand fir scattered throughout. When Jason purchased the property the owner shared a timber cruise report on the mixed maple, alder and Douglas-fir stand. Jason knows he could place at least one house on the property, but prefers to keep it as forestland.

Jason's objectives are two-fold: 1) retirement income from a future harvest and; 2) retaining and enhancing the oak woodlands. He is intrigued by carbon markets and conservation easements, but doesn't want to enter into a long-term agreement if it means the forest will no longer be a source of retirement income.

Does Jason have the information he needs to evaluate his options? Does he need a timber cruise or an inventory?

As you will see from the articles in this issue, trees are but one element of the forest that can be, or maybe should be, inventoried. An inventory can be qualitative (excellent, good, fair, poor) or quantitative (thousand board feet, trees/acre, cubic feet/second or animal units). As evidenced by the partial list below, you can inventory just about anything:

- Soils/Productivity
- Firewood
- Plants
- Habitat
  - Wildlife
  - Fisheries
- Infrastructure
  - Roads, Gates and Culverts

- · Property Corners
- · Water Sources (fire protection)
- · Easements
  - · · Benefiting
  - · · Encumbering
- Carbon
- Water Yields
- Grazing capacity
- Wildlife
  - · Game
  - · Non-Game
- Special Forest Products
  - · Salal
  - · Bear grass
  - · Ferns
  - · Boughs
  - · Burls
  - · Posts and Poles

So then the question becomes: What information do I need to know in order to make the decision(s) I need to make? The answer to that question will vary according to each woodland owner's objectives and the uniqueness of the forest property.

In the case of Doug and Lizzy, the decision has already been made to harvest. The 35-acre unit includes 100 percent of their forestland. They need a snapshot of current timber volume by specie and quality. A simple timber cruise is sufficient in this case. By applying current log prices to the cruise data, they can make an informed analysis of the offers to determine which is in their best interest. They may choose to share these data with the buyers and contractors. Everyone makes better decisions with good data and no one should be unhappy with a fair transaction.

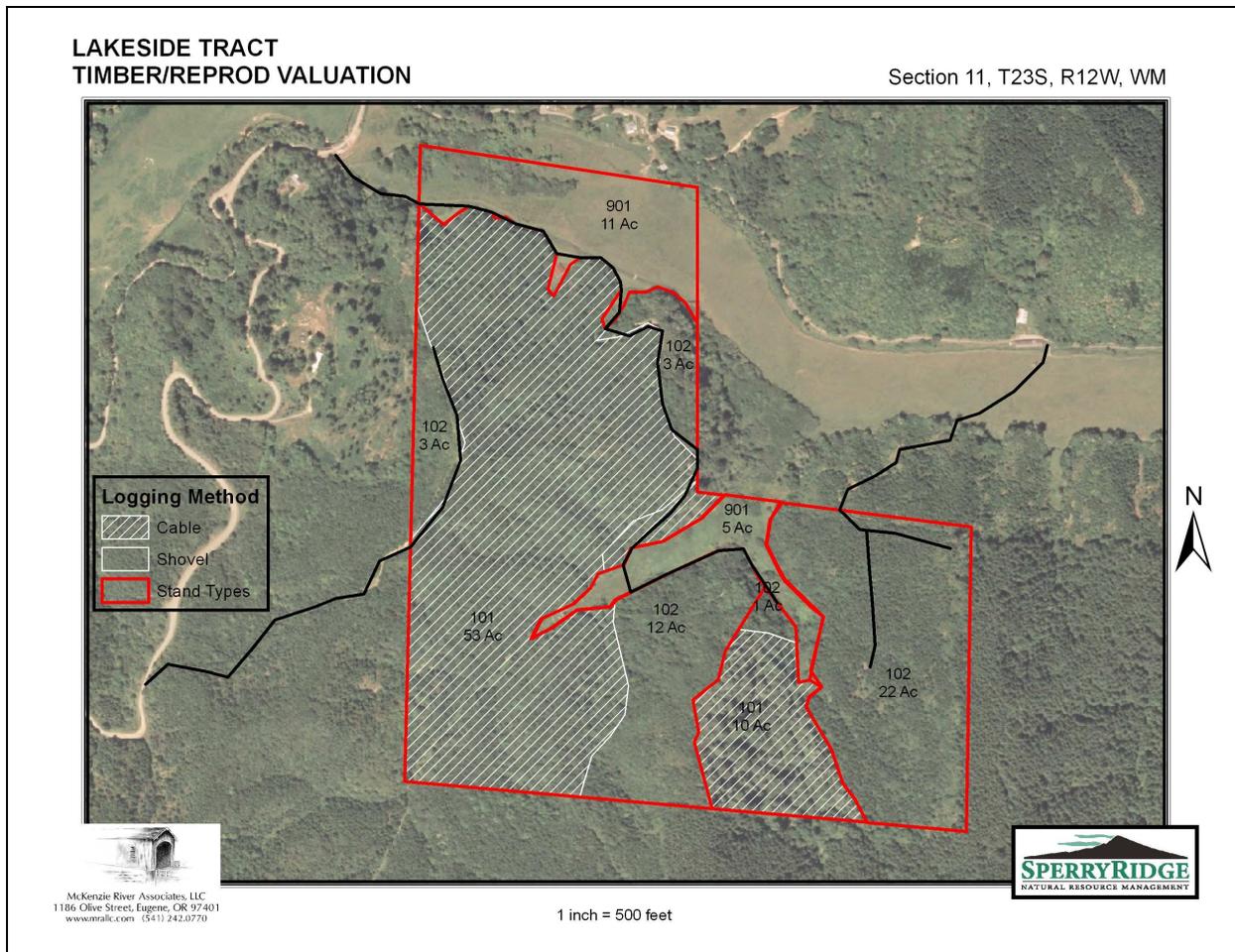
In Jason's case, the information he needs is more complex. The cruise data for the mixed stand of merchantable timber may be adequate if its harvest is imminent. On the other hand, the evaluation of potential carbon revenues, conservation easements or future timber harvests requires a look into the future. A snapshot of current conditions (i.e., a timber cruise) does not give him sufficient information to project future conditions.

This article will focus on measuring the most obvious component of the forest—trees. Keep in mind that whether you need a simple timber cruise or a complete timber inventory, it is an educational expense similar to college tuition. Obtaining knowledge is not only satisfying, but empowering. A landowner is handicapped and vulnerable in today's business climate if he or she knows less about their assets than those they may be doing business with; and they are also likely to make less-than-optimum management decisions without a reliable description of the current condition of their forest and how to achieve the desired future condition they seek. In other words, the cost to know is small compared to the cost of not knowing! Just ask any stewardship forester or forestry consultant who has been brought in after the fact.

A timber cruise provides a statement of the amount of merchantable timber volume, typically by species and grade, at a given point in time (the year of the cruise). Although knowing the total merchantable volume is usually a primary goal of a timber inventory, it can provide much more information than a timber cruise, be maintained by periodic cruises, and be updatable with

adjustments for growth and depletion. Other goals for timber inventories include growth modeling to compare silvicultural alternatives, harvest scheduling and management plan development.

The first step in developing an inventory is to delineate the property into stands of trees with similar characteristics such as species, size and density. This process is called stratification. Data to be recorded will be collected for each of the individual timber stands delineated in the stratification process for small ownerships, but just for a sample of stands for each timber type on properties larger than 2,000-3,000 acres.



The only data that should be collected is data that will contribute to the analyses to be performed. This sounds so obvious you may wonder why we mention it. A lot of time and money has been spent collecting data that is never used in an analysis. Sometimes those same data sets lacked important data that would have contributed greatly to the analysis. Examples of this are collecting non-tree species data when the growth model to be used does not address non-tree species, or not collecting total tree height when using a growth model that relies heavily on total height in determining tree form.

Table 1 identifies critical data for a forest inventory capable of being grown and modeled. Collecting data on all trees, not just merchantable trees, is imperative if growth projections are anticipated.

**Table 1.**

<b>Data to Collect</b>	<b>Why Collect this Data?</b>
Stand ID	Positively identify which timber stand the data belongs to.
Date	The date of data collection becomes the base date for growing the timber stand into the future.
Cruiser	Knowing who cruised the stand provides accountability and an audit trail for asking and clarifying questions.
Merchantable Plot Type	This may be a variable radius (prism) plot or a fixed area plot.
Merchantable Diameter Limit	This is the minimum diameter of the trees sampled on the merchantable plot. All trees less than this diameter are sampled on the sub-merchantable plot.
Merchantable Plot Size	This is the area of the fixed plot for merchantable size trees on fixed area cruises.
Basal Area Factor (BAF)	This is the basal area factor used for variable radius (prism) cruises. The BAF should not be changed within the timber stand, but may be changed between stands.
Sub-merchantable Plot Size	This is the area of the fixed plot for sub-merchantable trees. This is typically a smaller plot centered on the plot center of the merchantable plot.
Species	The species is necessary for applying different growth, tree form and treatment responses by the inventory software. It is also necessary for applying appropriate log values to the reported volume.
Group or Component Code	This is a very useful piece of data. It can be used to identify old growth from young growth, wildlife trees or any special designation you may require.
DBH	This is the diameter at breast height (4 ½ feet above ground level on the uphill side of the tree.) This measurement is used in describing the shape of the tree and is a standard way of reporting volumes by size class.
Taper Measurement	Tree volume is directly related to tree form. Taper measurements are used to describe tree form. Typically taper measurements are the diameter at the top of the first 16- or 32-foot log, the height to the point where the bole is 80% of DBH, or any height/diameter pair.
Total Height	Total height is used with species, DBH, and the taper measurement to develop tree volume and shape. It is also used to determine the site index.
Live Crown Ratio	This measurement describes the percent of the total tree height that contains a live crown. It is used in growth projections.
Crown Class	The crown class describes whether the tree is a dominant, co-dominant, intermediate or suppressed tree. It is also used in the growth projection process.
Age	Total age or breast height age is used in conjunction with total height to determine the site index. The site index is measured on trees that have been free to grow their entire life and do not exhibit malformations or defects.
Grade	This measurement is important for determination of current value, but loses its importance in the inventory as trees are

	grown into the future. Insufficient data exists to accurately predict how grade will change in a log over time.
Defect	The estimate of defect is based on visible indicators and is used to develop the net volume.

Not all data must be collected on all plots. Most inventory programs utilize sub-samples of data to develop regression curves. These curves are used to predict tree form and size on the remainder of the data collected. In addition to the data described above, other data may be needed depending on the inventory goals. Such data may include the presence of other vegetation besides tree species and notes regarding wildlife.

Robust inventory databases typically interface with geographic information system (GIS) databases. Consequently, other data often collected or downloaded from various internet sites include slope, aspect, elevation, average annual precipitation, soil type, streams, roads and improvements. These data further describe the stratified timber stands by developing a habitat description that greatly enhances the accuracy of a sophisticated growth model. Note: Although small landowners are not likely to own GIS software, this work can be done in a cost efficient way by a consultant.

A couple caveats should be noted here.

- 1) The old adage “garbage in, garbage out” clearly applies to forest measurements. Bad information can be even more costly than no information.
- 2) It is important to understand the information and its limitations. For example, typically the statistical accuracy of an inventory on a stand basis is less than that of a timber cruise. This is due to a difference in the number of plots, or sampling intensity. What is the appropriate level of accuracy? As always, the answer is: it depends. It depends on the financial stakes, your comfort with risk and cost. A 10 percent +/- standard will be much more costly to achieve in a highly variable stand than in a well-stocked, even-aged, one-species stand. Ten percent +/- accuracy is much less costly to obtain on a forest-wide basis than on a stand basis. Ultimately it comes down to a cost-benefit assessment for each specific situation.

While the Menzies and Jason have very different situations and objectives, having good information about their forests will enable them to make wise decisions and help them meet their financial and silvicultural objectives. The forest is a dynamic and complex system and seldom will it be possible to remove all the variables, but with good information you can certainly put the odds in your favor. The next time Doug, Lizzy and Jason visit their woodlands they can enjoy the experience without lingering doubts and uncertainty, because they will know that their decisions were made based on good information.

*Fred Sperry is a Certified Forester, member of the Association of Consulting Foresters and owner of Sperry Ridge Inc., a private consulting firm in Oregon. Fred is also an Oregon Real Estate broker and owner of NW Forest Properties, LLC. He can be reached at [freds@sperryridge.com](mailto:freds@sperryridge.com) or 541-505-3377; or visit [www.SperryRidge.com](http://www.SperryRidge.com). James A. Mehrwein is the owner of McKenzie River Associates, LLC, a Certified Forester, a Registered Professional Forester in California, and a Certified Lead Auditor with the American Tree Farm System. He can be reached at [jimm@mrallc.com](mailto:jimm@mrallc.com) or 541-242-0770, or visit [www.mrallc.com](http://www.mrallc.com).*