HW Buck for Windows: The Optimal Hardwood Log Bucking Decision Simulator with Expanded Capabilities

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ABSTRACT

It has long been recognized that inappropriate placement of crosscuts when manufacturing hardwood logs from harvested stems (log bucking) reduces the value of logs produced. Recent studies have estimated losses in the range from 28% to 38% in the lake states region. These estimates were developed by evaluating the bucking cuts chosen by harvesting crews and comparing them to the optimal bucking pattern chosen by HW Buck, a computerize tool to optimize the choice of bucking cuts for hardwood logs. These losses are not surprising because the hardwood log bucking problem is very complicated. Hardwood log grading and scaling rules are complex. Furthermore, hardwood stems tend to be less straight than softwoods, and have grade and scale reducing defects scattered along the entire stem. The original DOS version of HW Buck, which was recognized by the NHLA Hardwood Research Award in 1996, was very useful. However, it was written to run on the DOS operating system, which limits its current utility. The DOS version also did not have the flexibility required to accurately depict the complexity of hardwood markets, which vary by species, region, and even organization. This article introduces the recently developed Windows version of HW Buck. There are many new capabilities to enhance flexibility as a training and research tool. Some of the most important additions are the ability to define additional log rules, include roundwood products other than veneer and sawlogs, and enhanced ability to alter grading rules.

Keywords: Optimal hardwood log bucking decision simulator

INTRODUCTION

Pickens et al. (1992) first addressed the issue of potential value that is lost when field buckers convert hardwood stems to logs. This work was conducted in the Upper Peninsula of Michigan and identified value losses of between 28% and 35% depending on which set of historical prices was used. The magnitude of this loss has since been confirmed by a subsequent training program in Wisconsin (Pickens et al. 2005). The optimal bucking patterns showed greater volume recovery from the higher value grades and lower volume recovery from the poorer grades. Although the optimal bucking patterns tended to remove far more cull sections, the scaled volume was slightly higher than the scaled volume recovered by the field buckers. This occurred because the optimal bucking patterns produced logs with less sweep, and therefore less scale deduction for sweep.

The same investigators later developed a computerized hardwood log bucking decision simulator named HW Buck (Pickens et al. 1993) to help train log buckers to select bucking cuts that more closely approach the potential value of the stem. The contribution of this program, referred to as the "bucking game," was recognized as important when the research was cited as the 1994 Hardwood Research Award recipient by the National Hardwood Lumber Association. Its value as a research and training tool was, however, limited because it was written for a DOS platform and it had limited flexibility to adapt to the full range of market conditions across the eastern hardwood region.

The HW Buck program has been rewritten as a Windows program, which allows much more familiar operation for most users. Furthermore, the software system has been adapted to make it much more flexible to better fit the wide range of situations that occur in hardwood log markets across the eastern hardwood region. The resulting product will be described in the remainder of this article.

HW BUCK FOR WINDOWS

The software uses pull-down menus to facilitate navigation through the various processes. The "Game" menu contains most of the commonly used options for the Windows version of HW Buck (Figure 1). These options are split into two groups. The top group provides a range of ways the user can play the bucking game. The "Buck With Optimal" option is the traditional operation from the DOS version of the program. The user is allowed to select a tree stem to buck, then can rotate the stem to see hidden defects and stem shape. The user then selects their choice of bucking cuts and can compare their cuts with the optimal sequence of decisions calculated by the software (Figure 2). The two views shown in the figure are rotated so that both sides of the stem are visible. The comparison page reports the log grade, small end inside bark diameter (sed), total sweep, percent cull deduction due to sweep (S), and total percent cull deduction (C).

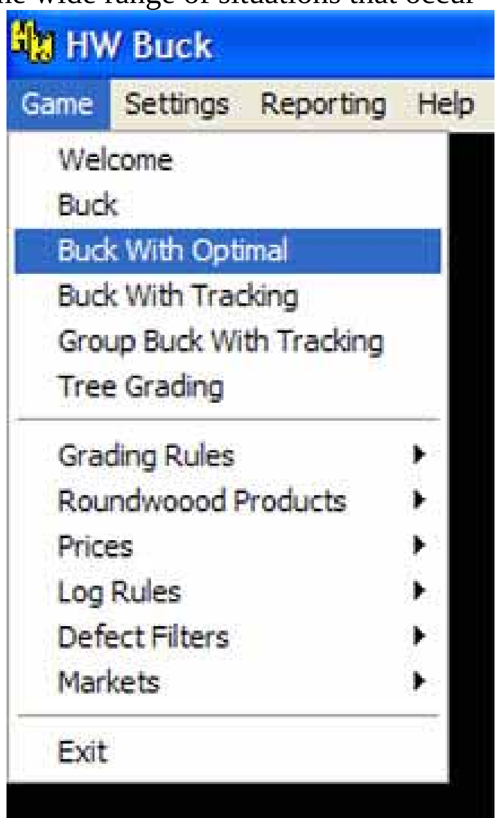

Figure 1: Options available within the Game pull-down menu.

The trainee-chosen bucking pattern included in this figure is to cut all 8' logs, which is a strategy employed by many log buckers in the Lake States. For this tree, the strategy of cutting all 8’ logs was a very poor approach that recovered only $114 of a possible $259 for the stem. The optimal bucking pattern identified two prime veneer logs by eliminating sweep and cutting out cull sections with defects. Pickens et al. (2005) discuss a comprehensive training program that was able to reduce the value lost by buckers by about 50%. This training involves defect identification, grading and scaling, and bucking to improve value recovery training. The 50% reduction in value loss was measured one year after the initial training during a revisit of the buckers at a logging site.

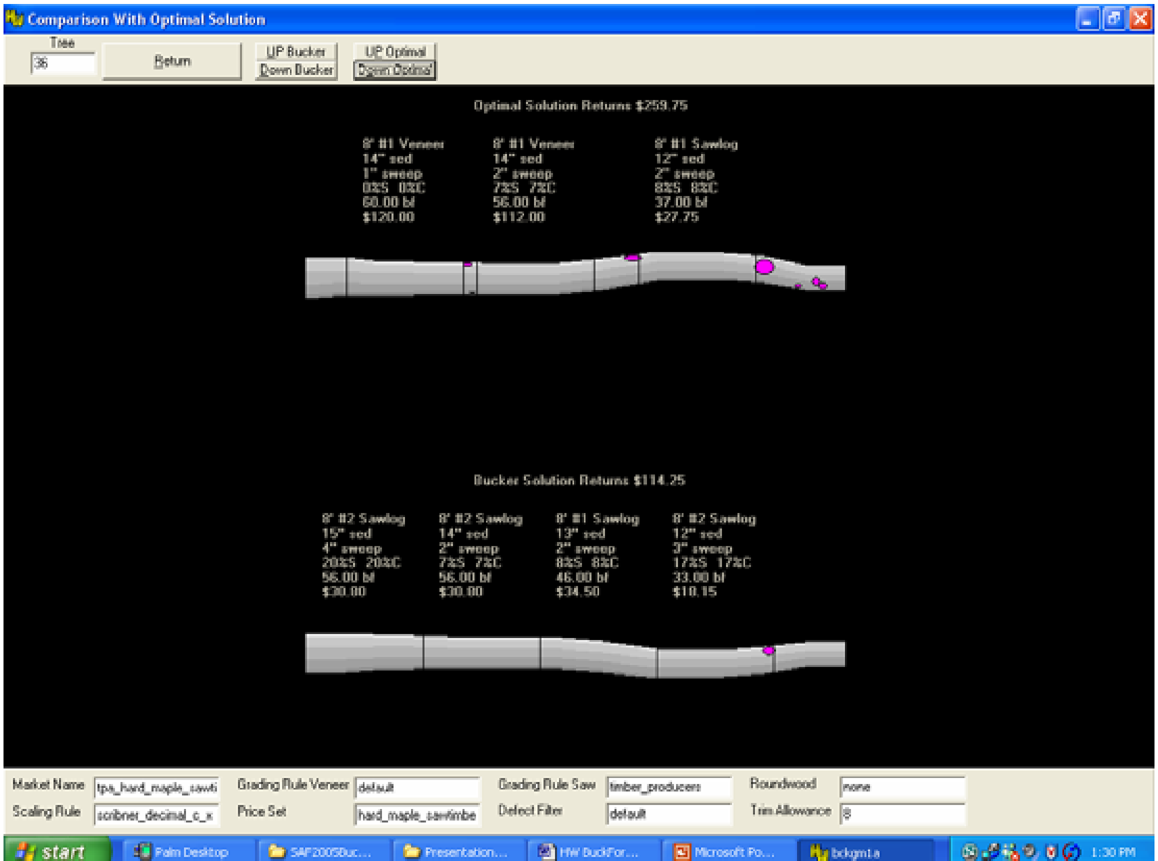

Figure 2: The HW Buck comparison page, which shows the trainee’s results for comparison with the optimal bucking pattern.

Three of the other options in the top group of the Game menu are new with the Windows version and involve having a trainee buck logs and have the results of their bucking decisions evaluated. The Buck option only displays the trainee’s results, without the optimal solution, on the comparison page. This option was developed specifically for log bucker training. Log buckers using this option can compete with their fellow trainees without having the optimal bucking pattern displayed. Essentially, when the optimal solution is presented, all attention focuses on it and the trainees only question is “what did I do wrong.” Although this is an important piece of information, another important part is for the trainees to look at what they did right. By only viewing the trainee results, attention remains on the bucking problem and how better decisions can be made. This approach is particularly useful when a group of buckers is competing with each other.

The process leads buckers to develop their own cutting strategies, both individually and as a group.

"Buck With Tracking" and "Group Buck With Tracking" are two options that allow the trainees to evaluate their performance over several stems rather than only one stem at a time. This allows the buckers to get a better feel for their long-term performance, and also facilitates competition between trainees. Trainees have responded very well to these options. The final two options in the buck menu are credits and the option of tree grading stems.

MARKETS IN HW BUCK

HW Buck brings together all of the information needed to define tree bucking in a given situation by creating a market. This information includes sawlog and veneer grading rules, definition of additional roundwood products, selection of a log rule for measuring volumes, product prices by log grade and length, selection of which defects are considered as grading defects, and the required trim allowance (Figure 3). Most of the flexibility in creating markets is new with the Windows version of HW Buck. Specifically, the ability to alter sawlog grading rules, define additional roundwood products, definition of or selection from a more robust set of log rules, filtering defects, and selecting the required trim allowance are new capabilities.

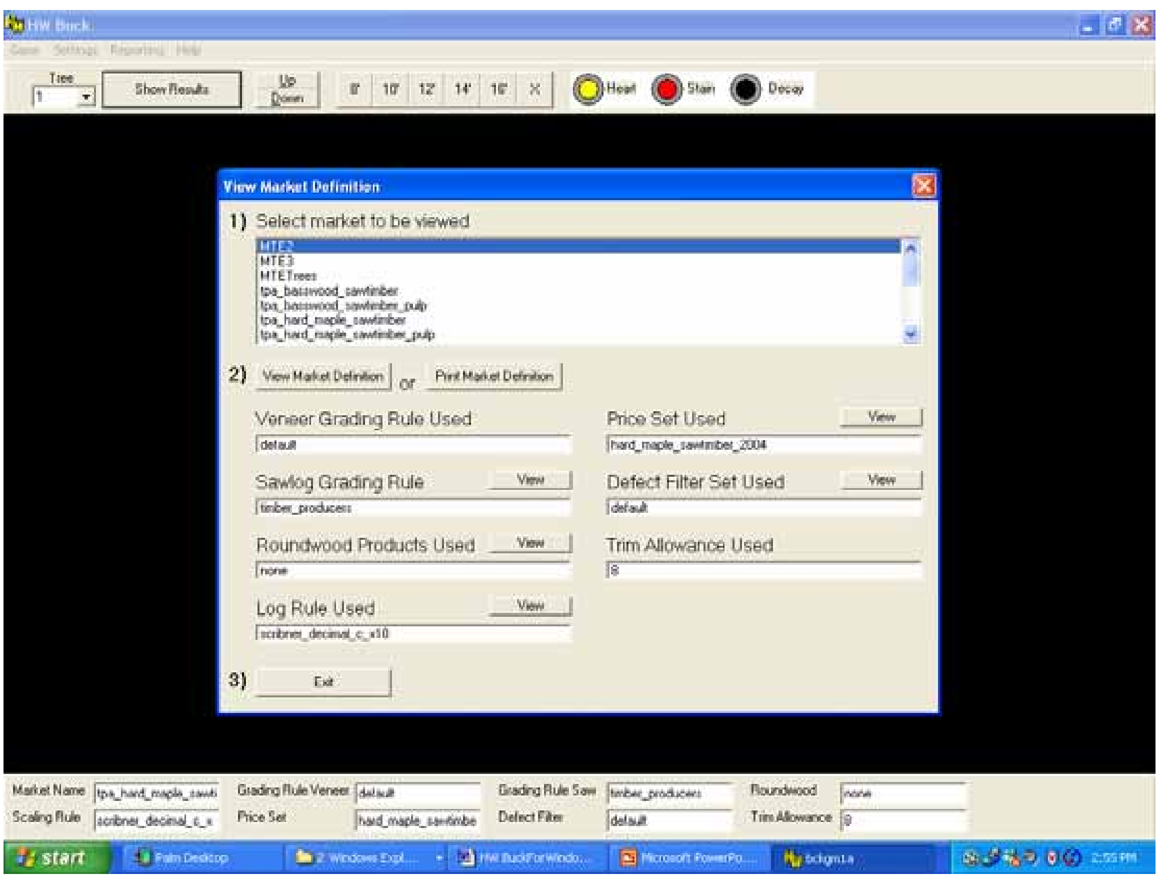

Figure 3: The information needed to create a market in HW Buck.

The ability to create alternative grading rules for both sawlogs and veneer is a very important step to address the range of market conditions encountered in the eastern hardwood region. The original set of sawlog grading rules in the DOS version of HW Buck was the *Official Grading Rules for Northern Hardwood and Softwood Logs and Tie Cuts* produced by the Timber Producers Association of Michigan and Wisconsin (1988). This set of rules is based on the length of the grading face that is in clearcuttings of at least a given length, with the grading face defined as the second worse face. The required length and maximum number of allowed clearcuttings are dependent on sawlog grade and log diameter. The Windows version of the software allows the user much flexibility to alter the rules within this basic approach. Furthermore, the software allows sawlogs to be graded using alternative methods based on the number of clear faces.

Another major improvement in the Windows version is the ability to view much of the data used when a market was previously created (Figure 4). The inability to view previously defined information was a frustrating weakness of the DOS version of HW Buck.

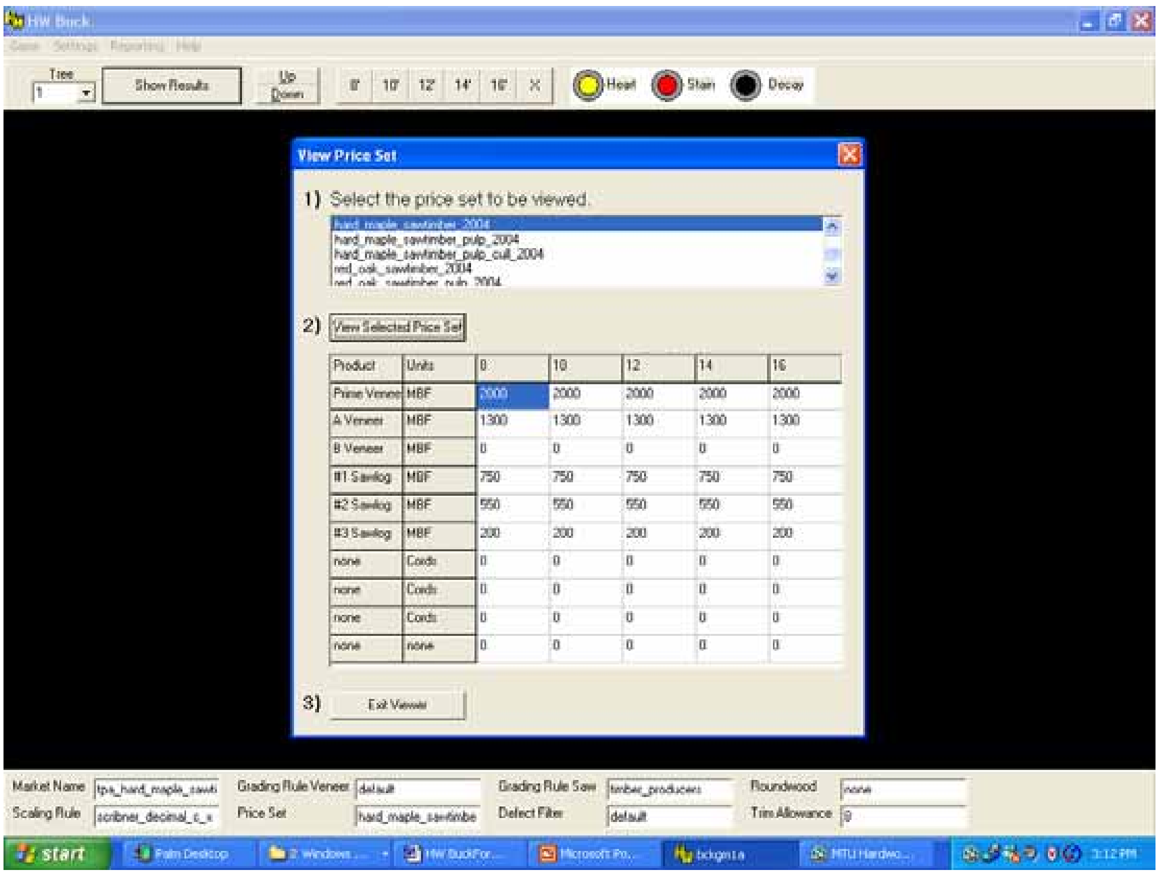

Figure 4: Previously defined data can be easily viewed in the Windows version of HW Buck.

THE NEXT STEPS TO BETTER VALUE RECOVERY

Given the large losses from current field bucking practice, and the associated large potential gains from bucker training to improve value recovery in hardwood log bucking, there is much potential value to be gained by improving the bucking of hardwood stems into logs. Unfortunately, this is not an easy problem to solve. There are two very different approaches that show tremendous promise, but each also has potential difficulties.

The first approach is to acquire data on hardwood stems, enter the data into HW Buck, and find the optimal bucking pattern. This option has tremendous potential in the long run, but faces several problems. To be economically viable, much of the data would need to be gathered using remote sensing techniques. The data HW Buck needs can be divided logically into two types. The first type is information about the shape of the stem, and includes diameter, taper, and the occurrence of sweep or crook. This information is relatively easy to collect with a wide range of remote sensing technologies such as optical light and laser. The second type of information concerns the occurrence and pattern of defects along the stem. Many of these defects, such as many overgrown knots, can be sensed with the same technologies as stem shape because their indicators cause shape differences. Unfortunately, many cannot be detected by optical light or laser approaches. This is the case for light bark distortions, bird peck, some seams, and decay holes. There are other remote sensing techniques, such as ultrasound and x-ray, which can look into the stem to identify the occurrence and extent of defects. These technologies are very expensive and still experimental. There are other issues that would need to be addressed before implementation of a fully automated optimal hardwood log bucking facility. One that may prove particularly difficult is the degree of disaggregation in the hardwood harvesting industry. An automated approach would work best where there are few very large operators, but the hardwood harvesting industry tends to be exactly the opposite with many very small producers doing the harvesting.

The second approach is to train the log buckers working with harvesting crews to make better bucking decisions. This approach shows tremendous promise, but the training must cover several different skills. First, the log buckers need to be able to identify grading defects on the hardwood stems. Some defects are very easy to identify, but some are more vague. Second, the buckers need to understand the basics of the log grading and scaling rules and procedures used in the area where they work. Third, the training needs to include rules-of-thumb that will help them to recovery more value when bucking hardwoods. Furthermore, regional variation due to species, product markets, and locally customized specifications make the same training that worked one place possibly inappropriate for other places. Pickens et al. (2005) have developed a log bucker training program that incorporates all of these attributes. This program has been shown to reduce the value lost by field buckers by 50%, reducing the loss from 38% to 19% one year after training. Plans to deliver this program across the eastern hardwood region are approaching completion. The Ohio Forestry Association (OFA), with collaboration and support from the Wood Education Resource Center (WERC) of the USDA Forest Service, is in the process of developing a program to transfer the training program and technologies used in the previous study to individuals familiar with local market conditions across the region.

LITERATURE CITED

Pickens, James B., Aaron Everett, Scott Noble, John Baumgras, Phil Araman, Conrad Waniger, and Al Steele. 2005. Intensive Hardwood Log Bucker Training using HW Buck Dramatically Improves Value Recovery. Also appearing in these proceedings.

Pickens, James B., Andrew Lee, and Gary W. Lyon. 1992. Optimal bucking of northern hardwoods. Northern Journal of Applied Forestry 9(4):149-152.

Pickens, James B., Gary W. Lyon, Andrew Lee, and W.E. Frayer. 1993. HW-BUCK computer game improves hardwood bucking skills. Journal of Forestry 91(8):42-45.

Timber Producers Association of Michigan and Wisconsin. 1988. Official grading rules for northern hardwood and softwood logs and tie cuts. 22 p.