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FALLING AND BUCKING: A LOG QUALITY CONTROL PROGRAM

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by
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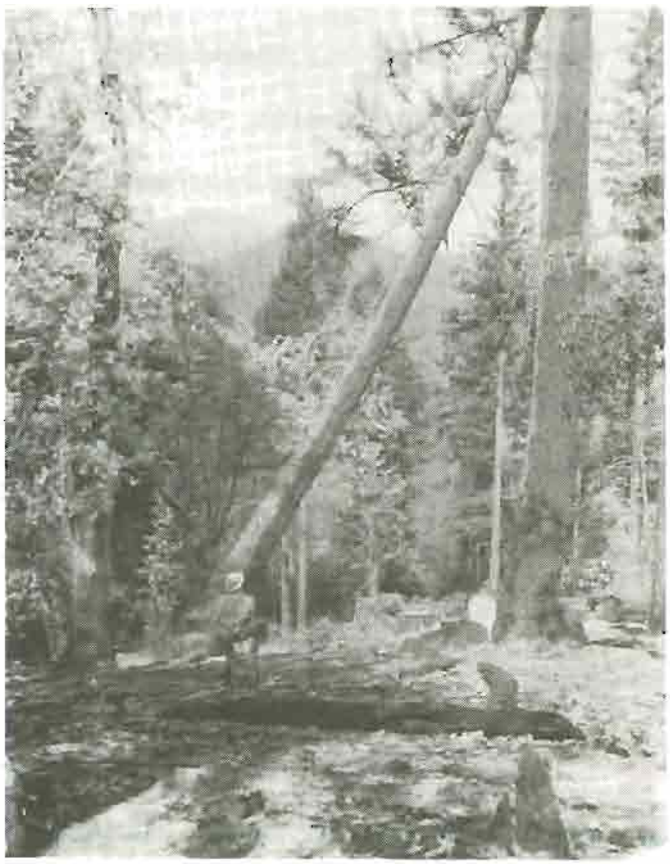

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ABSTRACT

The Falling and Bucking Program (FAB), is a computer based quality control program originally developed by the U. S. Forest Service. Recent improvements have made the program available to the logging industry for use on personal computers (FABPC). This article discusses the industry's use of FABPC as a woods quality control tool along with a description of its capabilities. The logging industry is encouraged to investigate the use of fall and buck studies as a means of documenting logging performance over time.

FALLING AND BUCKING: A QUALITY CONTROL PROGRAM

INTRODUCTION

The logging industry in California is constantly striving to achieve higher levels of efficiency. Success at reaching this goal depends on industry's technical skills and timber stand characteristics that affect harvesting practices. Losses due to stand characteristics will occur with any timber harvest. However, efficient timber operators recognize the value obtained from minimizing losses due to poor falling and bucking techniques. Improved falling and bucking will also result in efficient resource use and increased timber value.

For the purposes of this article, efficient resource use means converting all merchantable portions of a standing tree to log products (i.e., sawlogs, veneer logs, etc.). All reasonable efforts are used to minimize losses due to breakage, improper trim, and otherwise unused merchantable volume.

Timber harvesting operations of today often employ computer programs that monitor the conversion of standing trees to logs. These logs possess certain qualities making them more or less valuable to the buyer. The attention a logger gives to product quality is critical to a successful operation. Breakage, proper trim, and preferred lengths all contribute to product quality, and are variables easily monitored by computer programs (Figure 1).

FIGURE 1. Improper trim allowance is a variable that contributes to log quality.

This article introduces industry to the latest version of an old friend, FAB; a Falling and Bucking computer program. FAB has recently undergone some changes in the areas of user friendliness and availability. The most significant change is the conversion from a main frame program to a personal computer version, hence, the birth of FABPC. For the sake of simplicity, the Falling and Bucking program will be referred to as FAB except where specific reference to FABPC is made.

THE BENEFITS OF CONDUCTING FALLING AND BUCKING EVALUATIONS

A primary benefit is one of documentation. Breakage, for example, can be documented using FABPC in one of two ways; breakage allowable or avoidable (Figure 2). Total breakage is accounted for by either method, but the losses attributed to the faller are different for each. Of course, it is not realistic to expect any faller to eliminate all breakage. The objective should be to minimize the loss, and an important first step is to quantify how much occurs and under what conditions. FABPC can serve as your primary tool for documentation.

FIGURE 2: Recording breaks as "allowable" forces the computer to buck around them just as the faller must. A breakage "avoidable" code allows the computer to reconstruct the tree using the break as if it had not occurred.

Research for this article included interviews with past users of the main frame version of FAB. Most viewed the program as a tremendous teaching tool that raises the awareness of all who use it.

Scott Leonhard (Forester, Bohemia, Inc., Grass Valley, California), regarded his experience with FAB as positive in that it identified both good and bad habits (Figure 3).

A

B

FIGURE 3. Good habits include careful placement of undercuts and backcuts (A) to maintain control, and adequate limbing close to the bark (B).

The idea of raising awareness was further supported by Larry Costa and Bill Wade (Log Quality Control Superintendent and Forester respectively for Georgia-Pacific Corporation, Fort Bragg, California). Mr. Costa stated that:

"Before FAB, quality control in some cases consisted of a walk-through without measurement occurring. This sometimes produced false impressions as to actual operator performance. FAB allows for detailed measurements, giving a more objective view of recovery."

Mr. Wade is largely responsible for collecting tree data, performing 30 to 50 studies per year. Figure 4 illustrates the extensive work Georgia-Pacific has done with the FAB program.

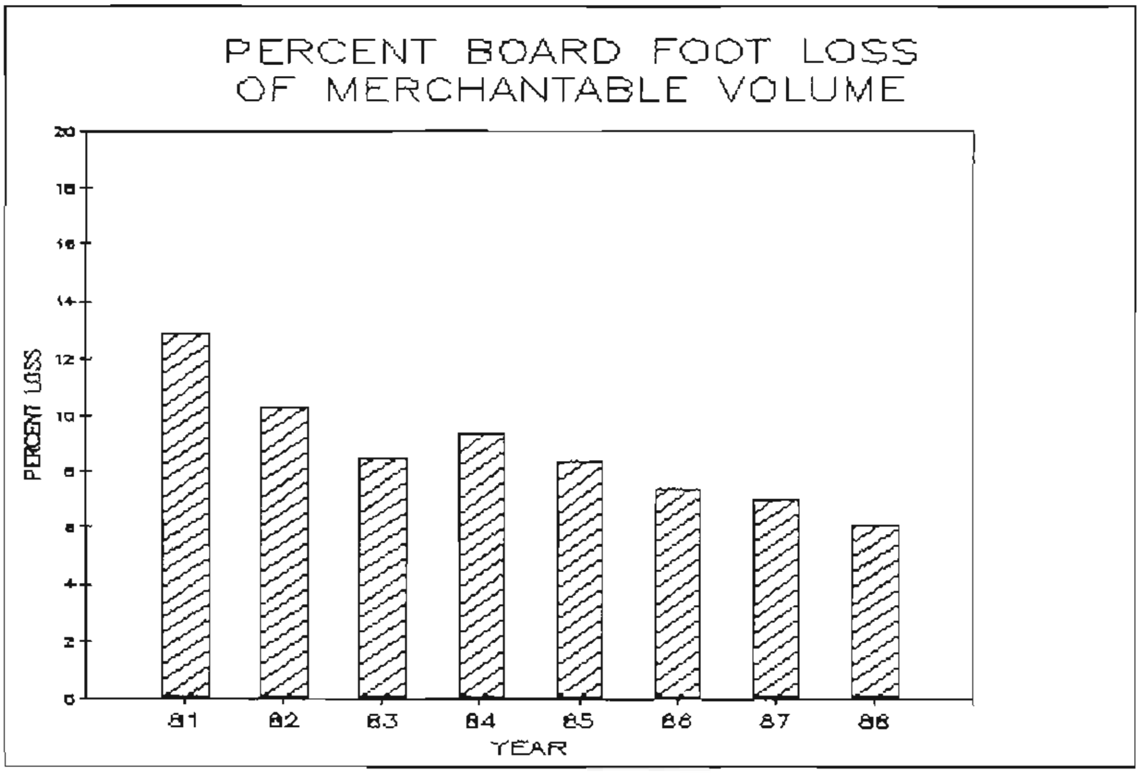

FIGURE 4. Average percent board foot loss in merchantable volume as measured by the FAB Program. (Data compiled and supplied by Georgia-Pacific Corporation, Fort Bragg, California).

Figure 4 shows a steady decline in losses due to harvesting, with 1984 being the only exception. Pete Ribar (Contract Logging Superintendent) attributes much of their success to a concentrated effort on quality control, while using FAB as a means for documenting their success. He further states that FAB has been used to inform fallers of their importance to downstream operations, and the concern Georgia-Pacific has for quality control.

Similar success has been reported from Washington state. Ron Smith, (Assistant Forest Manager, Buse Timber and Sales, Everett, Washington) noted several benefits credited to the FAB program:

1. Improved production of preferred log lengths.

2. Reduced losses from incorrect trim.

3. Better utilization resulting from cutters being more aware of log values.

4. Increased communication between our personnel, our loggers, and our cutters.

Of course, not all companies select FAB as their primary quality control tool. Foresters at Michigan-California Lumber Company, Camino, California, developed a program that is similar to FAB; however, it is designed to meet specific company needs. Henry Alden (Head Forester) indicated that the bucking simulation routine of FAB was not as important as simply documenting operator performance. Their program is successful in that it has also provided information for developing other forest management tools, such as site specific volume tables.

FAB: A HISTORICAL PERSPECTIVE

FAB began in 1975, as part of the Forest Service's Improved Harvesting Program, and is carried out in cooperation with state forestry agencies. In California, the program is administered by utilization specialists with the California Department of Forestry and Fire Protection. FAB's primary use has been as a tool to promote the benefits of improved utilization. This is accomplished through cooperative studies with industry that evaluate the conversion of standing trees to log products.

Prior to the development of FABPC, nearly 2,200 FAB evaluations covering 43 states were processed by the U. S. Forest Service's National Harvesting Group. Two-thirds of these were completed in the west, with California and Washington leading at 350 and 480 evaluations respectively. Data for California indicates that losses due to falling and bucking average 6.4 percent of standing merchantable volume measured in cubic feet; 7.6 percent when measured in Scribner board feet.

As a main frame program, FAB data was sent by mail to a computer center for processing. Many companies viewed this lack of immediate access to study results as a handicap to using FAB on a continual basis. For most companies, FAB served only as a tool for periodic evaluation rather than as a regular component of quality control. California later shortened the turn around time by sending data directly via computer terminals, an option not available to industry. The creation of FABPC solves the problems associated with long turn around times and lack of user access. It is now possible to collect data and produce results in the same day.

THE MECHANICS OF DOING A FAB EVALUATION

Initial Contact

In most cases, a company's first exposure to FAB is through contact with state or federal utilization specialists. They introduce the program, explain its capabilities, and identify the instructions used by the faller for bucking trees into log products. Bucking instructions are often in the form of a cutting card carried by the faller (Table 1). These are the same instructions used by the computer to select the most preferred log lengths and proper trim. Essentially, a FAB evaluation tests the faller's ability to produce logs according to the instructions.

Table 1 contains the required information for producing a product priority table (Appendix A). The product priority table lists the desired products in order of preference and in a format that can be used by the FABPC Program. In this case, two tables aree used by the computer, white fire veneer and sawlogs, and ponderosa pine sawlogs.

Data Collection

Data collection begins by selecting a set of sample trees after they are felled. Sample sizes of 25 are recommended; however, they usually vary between 10 and 25, depending on available time and the number of fallers to be evaluated on any given day. An important point to note here is that results are easily biased by selecting for unusual traits. For example, the data collector should select trees randomly, avoiding excessive breakage which is not typical of the overall operation.

Just as selecting nonrepresentative trees will bias study results, collecting data in a nonsystematic manner will make comparative studies impossible. For example, one data collector might measure breakage on all segments of a tree from the butt log to the minimum top diameter. For another, any breakage occurring above the point where the faller stopped manufacturing logs is ignored as acceptable loss. Obviously, these two data sets are not comparable.

Table 1. Sample cutting card for hypothetical timber faller.

		White Fir Length	Ponderosa Pine Length	Instructions
VENEER LOG	(VN)	34		Trim:
" "	"	26		Logs 20 feet and greater.
" "	"	17		Min. = 10 inches
SAWLOG	(SL)	32	32	Max. = 14 inches
"	"	16	30	
"	"	40	28	Logs 18 feet and less.
"	"	38	26	Min. = 4 inches
"	"	36	24	Max. = 8 inches
"	"	18	22	
"	"	30	14	Min. Top Dia.."
"	"	28	12	8 inches for Sawlogs
"	"	24	10	12 inches for Veneer Logs
"	"	22	20	
"	"	14		
"	"	12		
"	"	10		

The essential data requirements for operating FABPC would include the diameter and length of each log. The potential merchantable volume is accounted for by measuring high stumps lengths and diameters of broken sections, plus any sound material left in the woods. Improper bucking around crook, sweep, or cull segments is accounted for by establishing "must buck points" at appropriate locations along the stem.

Information for individual trees is recorded on FAB Form 1a found in Appendix B. Form 1a is a data entry card designed for one tree per card. This information is entered and stored in the computer using a program called FABIN. This process allows recall of tree data and results for future use. The FABIN program also allows for colecting information about the logging site and special observations for individual trees (Figures 5 and 6).

FIGURE 5. Additional characteristics concerning the logging site can be recorded in a comments section. For example, crossing timber is not always avoidable due to factors beyond the faller's control.

FIGURE 6. Additional observations related to log quality (stump pull) can be recorded using comment codes.

RESULTS FROM THE FABPC PROGRAM

FABPC does the actual number crunching for a Fall and Buck analysis by accessing the input file created by FABIN. The output from FABPC displays the results according to how the faller bucked each tree into various products. Losses are listed by category for each log according to how the data was collected. Some examples are shown below:

Misbuck (MB): Losses from under or overtrim.

Breakage (BR or BA): Expressed as avoidable or allowable breakage.

Buckout (BO): Solid, merchantable wood left that could have been manufactured into a log product.

Examination of the FABPC output illustrates several advantages to doing Fall and Buck evaluations. First, the faller can compare his bucking decisions with the computer's solution. This reinforces good decisions. Secondly, by comparing total merchantable volume in each tree to what was actually recovered, the faller develops a feeling for predicted recovery under different stand conditions. And, since FABPC records loss by category, the faller has determined where to concentrate his efforts for improvement. Some of the information displayed for each tree is presented in Table 2.

Table 2. Example of actual versus computer simulated bucking for tree number 1.(1)

ACTUAL BUCK

Product	Gross Cubic Feet	Volume Loss(2) Cubic Feet	Net Cubic Feet	Scribner Board Feet
Sawlog	90.1	.1 SB	90.0	540
Sawlog	23.9	.2 MB	23.3	140
		.4 ET		
Break	.7	.7 BR		
Sawlog	24.5	.1 ET	24.4	120
Break	7.9	7.9 BR		
Totals	147.1	9.4	137.7	800

COMPUTER BUCK

Product	Gross Cubic Feet	Volume Loss(2) Cubic Feet	Net Cubic Feet	Scribner Board Feet
Sawlog	89.9		89.9	540
Sawlog	45.9		45.9	260
Sawlog	11.0		11.0	40
Buckout	.2	.2 BO		
Totals	147.0	.2	146.8	840

(1) Additional information to the above is found in the computer print-out.

(2) BO = Buckout, ET = Excess Trim, BR = Break, MB = Misbuck, SB = Slant Buck.

FABPC will also display summary tables for all trees in a sample. Examples are shown in Tables 3 and 4 which show some of the information found in the log distribution tables. Log distribution tables are produced for each product by species and compare actual versus computer solutions.

Table 3. Log distribution table for ponderosa pine sawlogs comparing actual versus computer solutions. ([1])

		ACTUAL BUCK			COMPUTER BUCK		
Product Priority	Scaling Length	No. of Logs	Cubic Feet	Scribner Board Feet	No. of Logs	Cubic Feet	Scribner Board Feet
1	32	17	1444.6	9220	23	1818.9	11520
2	30	4	244.2	1520	0	.0	0
3	28	3	111.8	690	4	145.4	820
4	26	2	52.6	280	1	27.1	160
5	24	1	62.3	390	3	121.3	670
6	22	3	114.2	670	3	70.7	350
7	16	1	14.0	70	0	0	0
8	14	2	33.3	170	2	21.0	80
9	12	0	.0	0	2	15.8	80
10	10	8	101.2	590	6	70.0	390
11	20	2	42.3	190	0	.0	0
	Totals	43	2220.5	13790	44	2290.4	14070

([1]) Additional information to the above is found in the computer print-out.

Table 4. Value recovery is displayed for each species and product.

Ponderosa Pine Sawlogs Valued at $185/MBF

Product Priority	Scaling Length	ACTUAL BUCK No. of Logs	Board Feet (MBF)	Total Value($)	COMPUTER BUCK No. of Logs	Board Feet (MBF)	Total Value($)
1	32	17	9.220	1705.70	23	11.520	2131.20
2	30	4	1.520	281.20	0	.000	.00
3	28	3	.690	127.65	4	.820	151.70
4	26	2	.280	51.80	1	.160	29.60
5	24	1	.390	72.15	3	.670	123.95
6	22	3	.670	123.95	3	.350	64.75
7	16	1	.070	12.95	0	.000	.00
8	14	2	.170	31.45	2	.080	14.80
9	12	0	.000	.00	2	.080	14.80
10	10	8	.590	109.15	6	.390	72.15
11	20	2	.190	35.15	0	.000	.00
	Totals	43	13.790	2551.15	44	14.070	2602.95

Tables 3 and 4 show that high recovery is more than maximizing volume. In this case, 13,790 board feet were produced by the faller from 16 sample trees. The computer was able to capture an additional 280 board feet (Table 3) from the same trees, resulting in $51.80 additional value (Table 4). Note that the computer has increased value recovery by concentrating more volume in the most preferred log length (32 feet).

FAB users should not consider matching the computer's recovery as their primary objective. Many losses are unavoidable when falling and bucking timber for a variety of reasons including safety. FAB is best used to measure recovery over time, and identify potiential improvements in falling and bucking operations. This is accomplished by using the summary tables that express recovery as a percentage of total available volume, and examining losses by cause.

CONCLUSION

The Falling and Bucking Program is well documented as a tool that promotes efficient resource use. Its availability in a PC version has greatly enhanced its value, and is the most significant improvement in the program's history.

Efficient resource use requires skilled operators who make wise decisions. FAB is a tool that documents these qualities in a systematic manner. The results can be used to illustrate a job well done or identify areas where a concentrated effort is needed for improvement.

Computer programs by themselves do not constitute a complete quality control program. They are components of larger programs designed to deliver what the buyer needs. A complete program will include:

1. A means of documenting operator performance over time and under different stand conditions.

2. Realistic standards by which operators are expected to perform.

3. A method of providing positive feedback to the operator via the QC tool(s) employed.

4. Appropriate incentives that encourage a job well done.

The FAB program can assist timber operators with documentation and positive feedback. The computer output includes information on individual trees, and summaries of all trees sampled that measure the degree to which total available volume is used. This information when used correctly can form the basis of effective quality control programs.

For further information on the FAB Program contact:

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APPENDIX A

Product Priority Table

IMPROVED HARVESTING PROGRAM
BUCKING SECTION

EVALUATION 100

PRODUCT PRIORITIES

PRODUCT	PRODUCT LENGTH	MINIMUM DIAMETER	PRIORITY	TYPE	% MIX	TRIMS MINIMUM	TRIMS MAXIMUM
VN	34-00	12.0	1	F	0	-10	-14
VN	26-00	12.0	2	F	0	-10	-14
VN	17-00	12.0	3	F	0	-04	-08
SL	32-00	8.0	4	F	0	-10	-14
SL	16-00	8.0	5	F	0	-04	-08
SL	40-00	8.0	6	F	0	-10	-14
SL	38-00	8.0	7	F	0	-10	-14
SL	36-00	8.0	8	F	0	-10	-14
SL	18-00	8.0	9	F	0	-04	-08
SL	30-00	8.0	10	F	0	-10	-14
SL	28-00	8.0	11	F	0	-10	-14
SL	24-00	8.0	12	F	0	-10	-14
SL	22-00	8.0	13	F	0	-10	-14
SL	14-00	8.0	14	F	0	-04	-08
SL	12-00	8.0	15	F	0	-04	-08
SL	10-00	8.0	16	F	0	-04	-08

APPENDIX B

FAB Form 1a: DATA COLLECTION

USDA FOREST SERVICE
R1-3200-1a

TREE LEGEND

FAB1a (9/83)

FAB EVALUATION NUMBER	TREE NUMBER
01 LOGGING CREW	02 SAMPLE DATE
03 SPECIES	04 DATA COLLECTOR
00 COMMENTS	

MUST BUCK POINTS

	LENGTH (FEET)	CAUSE	FORK STEM ID	PRODUCT LENGTH (FEET)		LENGTH (FEET)	CAUSE	FORK STEM ID	PRODUCT LENGTH (FEET)
01					04				
02					05				
03					06				

ACTUAL BUCK SECTIONS

SEQUENCE #	PRODUCT	FORK	LENGTHS		DIAMETERS		CROOK SWEEP VOLUME				
					LARGE END	SMALL END					
			SHORT	AVERAGE	AVERAGE	AVERAGE	CODE	CR/SW AMOUNT (INCHES)	CROOK LENGTH (FEET)	MISC. VOLUME LOSS (CU. FT.)	COMMENT CODES

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