How to Improve Logging Profits

by

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NORTHEASTERN LOGGERS' ASSOCIATION, INC.

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Introduction

This book is a collection of 30 of the more than 50 articles originally published in The Northern Logger & Timber Processor magazine between early 1988 and early 1994, under the series title "How to Improve Logging Profits." The series became popular among readers for its valuable business insights. It was initially published as magazine articles and later compiled into this comprehensive book to assist loggers in business management, especially considering the evolving challenges in costs and market complexities.

2024 Update Note

This book was updated slightly for re-release in 2024 by the Northeastern Loggers' Association. **The update was made possible by the Farm Credit Northeast AgEnhancement Grant.** In most cases the text is the same as the **original.** In some case financial calculations were updated using contemporary cost figures. Outdated references were removed, and some were updated. Every effort was made to defer to Benjamin Hoffman's writing style and intentions in updating this publication.

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Chapter One

Setting up a Logging Business

Independence-Are You Ready for It?

The American way has meant independence in many things, including the opportunity to be one's own boss or even aspire to become president. However, starting your own business, especially in logging or sawmilling, can feel like a daunting task. Many logging contractors entered the business by chance, owning a pickup truck and chain saw, or skidder, and hiring someone to help cut a wood lot. The entry into this business is increasingly difficult due to high capital costs and the need for more planning and preparation as labor becomes scarce.

Hiring even one person brings moral and legal responsibilities. This includes compliance with various laws and maintaining accurate records for each employee, such as proof of citizenship, age, work hours, wages, and equipment rental. Issues around treating employees as subcontractors and the implications for social security, income, and unemployment taxes. The IRS has developed guidelines to determine whether a worker is an employee or an independent contractor. Consult IRS Publication 15 (2024) *Employers Tax Guide*, and IRS Publication 15-A (2024) *Employer's Supplemental Tax Guide* for further details (available at www.irs.gov).

Record-keeping requirements for employers include proof of citizenship, proof of age, record of hours worked, wages and equipment rental records, and compliance with state and municipal laws regarding logging. Employer tax responsibilities include FICA, federal and state withholding taxes, unemployment taxes, and workers' compensation insurance.

There are many sources of help available, often free of charge. Local bankers, Cooperative Extension Services (CES), and industry associations can provide valuable assistance. The importance of business skills in running a logging business and the option to hire someone with these skills. The role of family members, especially spouses, in supporting the business.

Starting a logging business takes capital, planning and preparation.

Self-employment in logging can be rewarding but is also demanding, requiring management of various business aspects beyond just logging. The need to stay on top of legal, physical, and economic aspects of the business environment. The often hectic and frustrating nature of self-employment, with long workdays being common.

The importance of careful consideration and awareness of all aspects involved in starting and running a logging business. Encouragement to seek out various viewpoints and experiences, and to consult IRS Publication 334 for further guidance.

Staying out of Trouble by Anticipating Cash Flow

The term "cash flow" refers to the flow of money through a business. Everyone wants "positive" cash flows – enough cash coming in from sales to pay the bills, including some profit for the business. If you don't have enough income to cover costs– a "negative" cash flow – you hold off paying bills until your income increases or you borrow to make up the difference. If either happens frequently, you are in trouble and need to determine why it happens and how to prevent it.

Accounting records track incomes and expenses of the past. As such, they provide a history that you should review periodically to see where you have been. But unless you project future incomes and expenses with a forecast of some sort, running your business is like driving a car with the rearview mirror. Many small business owners fail to make realistic forecasts, which is why most businesses fail in the early years. This is called 20/20 hindsight.

Some loggers are in financial trouble because they didn't look ahead. If they had ever stopped to think of all those unexpected things that keep happening – mud season, mill quotas, markets, money – they probably wouldn't have gone into debt in the first place. And rising tax, interest, and inflation rates in recent years have made it more difficult to get started in this business. But loggers are the most optimistic, trusting, resourceful, hard-working, and independent people I have ever met – traits that are important for success (with the possible exception of independence).

Projecting your own needs is fairly easy, but you also have to look ahead by paying attention to the markets you supply and the economic outlook for your customer's business.

You should keep at least a 12-month running forecast covering all seasons of your business. Then you can project estimates of stumpage price and volume production, markets, equipment, labor, and capital needs for each season in advance. By planning now for next year, you can take advantage of opportunities such as a good buy on a roadside lot for next mud season or an equipment bargain.

Projecting your own needs is fairly easy, but part of looking ahead is paying attention to the mills (markets) you supply and the economic outlook for their business.

Generally, the more diversified your output, the more stable your income flow. Being locked into one mill or product can be disastrous if it suffers a downturn in business. Softwood lumber is tied to the housing market and swings with home construction. Hardwood fluctuates with furniture and specialty markets that may vary by season but often improve when construction declines. Pulp and chip markets, including biomass fuels, also move seasonally and with the economy, but at different rates, in different seasons, for different reasons. Talk to wood buyers and mill owners and keep up with their concerns. Keep up with the market fluctuations with a trade journal such as *The Northern Logger*. Talk with other loggers and "filter" their gossip and future plans. What your competition does will affect your opportunities.

Looking ahead permits you to anticipate opportunities as well as possible problems. Mill expansion or modernization may mean a chance to expand or upgrade your own operation. And when you think of expansion, consider subcontracting or leasing rather than purchasing new equipment, especially for the short term. Before buying a new machine, consider the long-term consequences. More (or larger) payments can kill cash flow. Consider upgrading the equipment you have to boost productivity with the same or less labor.

Financing equipment reduces cash flows at the beginning of the payment period but raises them later. If you look at the accountant's estimate of income, or your annual income tax return, a machine's depreciation may be less than its payments, especially with a small down payment or trade-in. You may depreciate a machine over five years but pay for it in three. For a $200,000 machine, depreciation might average $32,000 per year, but payments may be over $53,000. Your tax return shows a profit, but you never have enough money. Accelerated tax depreciation helps increase income by reducing taxes in the early years but does not change the problem that develops later.

When the machine is paid for, depreciation is still $32,000, but payments stop. You now have a higher cash flow but don't spend it! People in every business get into trouble by spending this "extra" cash – sometimes called "living off depreciation." Set this money aside for buying your next machine, because inflation keeps jacking up prices of equipment and operating supplies, though wood prices never seem to keep up.

Building inventories of logs or stumpage reduces cash flow. Such assets may sometimes be used as loan collateral to qualify for lower interest rates on borrowed money, but you still face the expense of time and money to borrow. Accumulating excessive inventories of logs is rarely a problem with the hot logging common these days, but consider saving small

volumes of premium-priced grades and products until you have a minimum shipment. At the same time, consider the season and weigh the risk from insects and fungi.

When buying stumpage, have the owner defer payments until cutting begins. In lieu of a cash performance bond, consider insurance. Insurance premiums may exceed the cost of borrowing, but the insurance bond may be easier and more convenient to obtain. Only you can weigh the value of your time versus paying interest.

Cash income in excess of expenses does not mean a surplus. Don't let cash "burn a hole in your pocket" because inflation does not leave you enough money to burn – yet. But who knows? If inflation keeps up, money may eventually become cheaper to burn than wood.

Preparing a Simple Business Plan

Ben Franklin has been credited with saying *"If you fail to plan, you are planning to fail."* Winston Churchill and others have been credited with similar versions of this thought. More recently, people have observed that the number one killer of small businesses was the lack of a business plan.

Many loggers get into the business by accident; they never really planned it – it just happened. Consequently, many never even think of a business plan. Their objective is usually to generate an income to provide for their families with little thought to an overall objective, or next year or five years from now. Most loggers really run into trouble at retirement. "Now what do I do with the business?" they ask themselves. A simple business plan can help you anticipate and plan for the future and can be of tremendous help when you need to borrow money or trade machines.

A business plan is simply a statement of what you have, where you want to go, and how you are going to get there. It deals with monetary needs, both capital (equipment) and operating (meeting expenses through thick and thin). It can be as simple as a long-range calendar of monthly estimates of production, income, expenses, etc., which shows capital needs, cash flows, time to trade machines even seasonal market and production changes. From this you can anticipate stumpage needs – both wood volume to keep you busy and dollars to keep you running, including the need to skip payments. Seasonal variations forced by climate or ground conditions can be figured in so that major maintenance and workforce can be scheduled in advance, along with any borrowed operating capital.

A business plan is essential these days if you want to borrow money. Many established contractors have an experience record with their bank and don't need a formal plan, but any new business will need one. How well it is prepared – how realistic it seems – can affect the cost and availability of borrowed money. If there is profit to be made, there is always money available to finance the business.

A business plan, like a financial statement, is a scorecard. Sit down and study it periodically to see how you are doing compared with your plan. Revise the estimates to reflect changes in your equipment mix and productivity, stumpage rates, and mill prices. How does this month, or quarter, compare with last quarter or a year ago? What will it be like next quarter or next year?

Whenever you look back, or ahead, factor inflation into the picture. Set up your business plan in a spreadsheet and play "what if" games with the possible effects of changes. Change stumpage, mill prices, equipment costs, etc., to see how changes might affect you. If changes actually happen, see how they will affect you and then plan a strategy to take advantage of the situation.

Help is available from a variety of sources. Your bank is a good place to start – it will give you an outline of the type of information that should be in a plan. Your State's Cooperative Extension Service is another place to get free advice at the beginning. The information may not be tailored to logging, but

it will provide a good general background. The Small Business Administration (SBA) is another good source of free information.

A business plan is essential these days if you want to borrow money, and money is the one thing the modern logger needs as much as trees.

A really good place to look is the business school in your state university. Many universities have Small Business Development Centers, or "incubators," to help small businesses, and faculty at the business school is usually involved. There may be a student available, looking for a practical test of their knowledge, who will work with you. This is especially true of universities with both forestry and business administration programs. Your business can be a real-world experience for a student, in return for free assistance.

There is no substitute for a professional business advisor. This may be your accountant, or maybe your spouse can develop the needed skills. Initially, free help sources noted above are fine for getting started, but in the long run, someone with the time, talent, and interest in your business to check your progress is necessary. Your accountant tracks the past – history – but you need to look ahead and forecast changes that may occur in wood supplies, mill demands, product changes, new techniques and machines, new laws and regulations, and so on.

It pays to stay in touch with the rest of the industry. The Northeastern Loggers' Association and other groups have offered business training programs designed for loggers. Join the association and participate in workshops held in your area, attend seminars like those to be held at the annual Northeastern Loggers' Forest Products Equipment Expo, and read trade publications like *The Northern Logger*.

Being in business is just like paddling a canoe upstream. The stream meanders, wind and current constantly change, and rocks get in your way. You are constantly changing your course, and if you stop paddling, you slip back. A business plan, like a map of the stream, is a "map" for anticipating and preparing for change.

Chapter Two

People Management

People Management

For every $100 in payroll a logging contractor might pay an additional $100 or more for taxes, insurance, supervision, administration, and so forth. One of the common methods of avoiding some of these costs – maybe a better term would be "evading" the costs – is "subcontracting." This term is in quotes because it has often been misused in the lumber business.

Anybody in business tries to nail costs down to a known value. Unfortunately, costs vary. Some costs are considered fixed in time – so much an hour, day, or week – but vary per unit of production. For example, a man with a chainsaw may cost $24.00 per hour, or $192.00 for an eight-hour day. If he cuts six cords of wood, the cost is $32.00 per cord, but if he cuts ten cords, the cost is $19.20 per cord. Naturally, if you were to hire a chopper to cut wood, you would prefer to pay him the fixed, or piece, rate of $19.20 per cord. If the chopper provides his own saw and transportation and receives minimal supervision, the all-too-frequent choice is to call him an "independent contractor" or subcontractor, and pay him the piece rate. Theoretically, the responsibility for paying taxes and insurance then falls on him.

But if he is not truly independent and doesn't pay those taxes, that cutter is legally your employee, and you become liable for the taxes, insurance, and any injury to him or other persons or property that he might cause while working for you. For this system to work, a bona fide contractual relationship must exist between contractor and subcontractor. See a lawyer about this, because IRS rules are very sticky, and a court could well rule against you.

A New York State self-insurance fund, the NY Lumbermen's Insurance Trust Fund, published the following list of questions you should ask to determine if you are engaged in an employer-employee or a contractor-subcontractor relationship:

1) Does the worker and not the employer control the means and methods of how the work is done?

2) Do I suggest but not order how the work is done?

3) Do both of us have the right to terminate this relationship at will?

4) Is the worker in a distinct occupation, trade, or business?

5) Does the worker hold his services out to the general public?

6) Does the worker have the required licenses, permits, certificates, etc., to engage in his work?

7) Is the worker doing business as a corporation?

8) Does the worker use an assumed business name?

9) Does the worker have a Federal Employment Insurance Number?

10) Is the work performed under the worker's firm name?

11) Does my firm not provide free training to the worker?

12) Does the worker perform the task without supervision from me?

13) Is the worker engaged in an activity requiring extensive skill, education, or expertise?

14) Is the routine or schedule established only by the worker?

15) Are regular reports from the worker not required?

16) Does the worker provide invoices to me?

17) Is the worker allowed to delegate or assign work to others?

18) Does the worker hire helpers from time to time?

19) Does the worker provide his own tools and equipment?

20) Does the worker have a significant monetary investment in his business?

21) Is the worker's business of sufficient substance that it could be sold?

22) Is the worker represented to others as a non-employee of my business?

23) Does the worker advertise his services?

24) Does the worker own or rent office space away from his home?

25) Is the job of relatively short duration?

26) Is the worker not paid by unit of time?

27) Do I not provide bonuses to the worker?

28) Does the worker carry his own insurance?

29) Are taxes not deducted or withheld from the worker's check?

30) Is the worker not guaranteed a minimum pay?

31) Does the firm not obtain bonds for the worker?

32) Is the work in question customarily performed by non-employees?

33) Does the worker work less than "full time" for me?

34) Does the worker not get a draw or advances?

35) Does the worker not get fringe benefits?

36) Is the worker not bound by anti-competition clauses in the IC contract?

37) Does the worker have multiple sources of income from the activity in question?

38) Does the worker have a risk of loss?

39) Is there a written contract with the worker?

40) Does the worker have the option not to attend company meetings?

41) Does the worker collect his fees directly from the customer?

42) Do I issue a form 1099-misc to the worker?

43) Do I not obtain the INS Form I-9 from the worker?

44) Do both parties believe they are creating an IC relationship?

45) Does the worker provide his own personal protective equipment?

"Yes" answers indicate Independent Contractor status. "No" answers indicate Employee status. If you do not have at least 80 percent yes answers, you probably are not using independent contractors. When you consider the possible fines and penalties for incorrect classification of workers, by the Workers' Compensation Board, Labor Department, and the Internal Revenue Service, are you really cutting expenses?

If the contractual relationship does not exist – the cutter is really your employee – can you still pay the piece rate? You can if you pay all the taxes and insurance. This will enable you to fix the rate of pay according to production, thus locking in your costs. But what happens if your employee gets into some poor wood and production drops? As long as wages are at least equal to the minimum wage, you're fine, but if wages drop below the minimum then you must raise them so that the employee is earning at least the minimum. Always check with your accountant or attorney to be sure that you are abiding by the law.

A related abuse is to pay an employee, or subcontractor, for the use of his machine – commonly rent for a saw or skidder, and usually on a piece-rate basis. This can be a trap for the employee, because the increased money flowing through his hands each week might be attractive, but may not cover his true costs. If the rental is not enough, then the wage becomes substandard, and you are violating the minimum wage law.

Another possible method of paying workers is to offer a base wage per hour with a bonus for production and/or grade. This is an incentive to do a better job, which permits both employer and employee to share in the benefits. A fair equipment rental is also a production incentive, especially with chain saws. An intelligent employee receiving either a bonus or rental will be sure that his equipment is in top operating shape at all times, for the simple reason that the more wood he produces, the more income he receives.

Many years ago, my boss gave me a little test, listed at the top of the next column for you to take. Obviously, times have changed, and the results came from studies of factory jobs and factory workers do think differently than loggers. The test is to rank employee needs in the order in which you think the worker would rank them. The most important would be 1, and the least important would be 10.

WHAT IS IMPORTANT TO EMPLOYEES IN THEIR JOB?

Needs	**Ranking**
1. Appreciation of work done	[ ]
2. Feeling "in" on things	[ ]
3. Help with personal problems	[ ]
4. Job security	[ ]
5. Good wages	[ ]

6. Interesting work [ ]

7. Promotion in company [ ]

8. Loyalty to workers [ ]

9. Good working conditions [ ]

10. Tactful disciplining [ ]

After you have ranked these from 1 to 10, compare your answers with those of 1,300 supervisors and 5,000 employees.* Surprised? Does your mind work like an employee or like a supervisor? This little exercise points out one thing – not all people think the same way. Their values are different. These differences result from family background, training, education, experience, and many other factors.

Never assume that an employee will think the same way as you. Also, never assume that an employee knows what you know. Ever ask somebody to do a job and then find it all botched? Was it botched because the employee made a mistake, or because you never explained how to do it properly? If they knew how and goofed, that's their fault, but if you never trained them, then it's your fault. Probably 90 percent of the time, screw-ups are the result of poor training, and that's the boss's fault!

Have you ever heard of the "mushroom method of personnel management?" That's when you keep people in the dark and feed them horse manure. And when someone sticks his head up, we chop it off. How does that fit the ten work conditions? Do you keep your employees in the dark and feed them horse manure, or do you try to sense how they feel and what their needs are? Money is not everything to workers; these days people can find a good reason to quit and draw unemployment rather than work in a mushroom factory. Get your employees involved in their work. Together, all of you know more than any one of you, and even the newest and youngest worker may have helpful ideas.

Hiring, training, and keeping good employees is a major problem in any business. It is especially difficult in logging because the work is physically hard, dangerous, and often done under adverse conditions. Give your employees the test – see how they think, what they consider to be important. Then, zero in on those things that you can improve. You may find that you can change a lot of things for the better – simply by changing your attitude.

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* Supervisor answers: 2,4,10,3,1,7,6,9,5,8

Employee answers: 1,2,3,4,5,6,7,8,9,10

Macho is Out

Many years ago, when I was production manager of a veneer mill, one of my neighbors came into my office with a distraught look on his face. He was holding his left thumb in the palm of his right hand – he had just sliced the thumb off with a veneer chopper, a nice, clean cut. Little blood – and he was in a state of shock and disbelief. Grisly? No, compared to the bloody logging accidents I have seen. But it was enough to shock me into getting our safety program into high gear.

We had the worst safety record in the nation for mills our size and had "enjoyed" this position for years. But early in 1967, we completed our first year since 1905 without a lost-time accident. How? A commitment by every person in that mill. Unfortunately, the motivating factor was partly greed, for as a last-ditch attempt, we began an incentive program based on grocery store green stamps–which could be collected and exchanged for products – for departments having the fewest accidents. Each accident-free month meant more stamps next month, and after a few months, the value of the stamps was significant. One lost-time accident took the level back down to zero.

If anyone injured at work was tempted to use it as an excuse for a few days off, that temptation was met by strong pressure from every fellow employee to work, not to convert it to a lost-time injury costing several hundred people their green stamps.

Safety is an attitude, and a commitment. It means wearing the proper safety gear when it is needed, regardless of what others say.

Most workers were sincerely interested in the safety of their fellow employees – which meant their safety too. The result was astounding. Everyone took an interest in safe working practices and safe working conditions. Employees cautioned each other about unsafe practices and began reporting any dangerous conditions and practices to management. And though management authorized much overtime work and materials to correct hazards, and costs of the incentive program escalated, profits rose. It was obvious that safety was not an expense – it paid off.

Are you safety conscious? Do you wear safety equipment, or are you one of those macho jerks with a hard head instead of a hard hat? I was, until I had a few stitches taken in the top of my head and bought hard hats for all of my crew. My chopper, who refused to wear his hat, was a macho jerk too until he was hit by a widowmaker and nearly killed. His son brought his hardhat to the hospital, handed it to him, and said, "Dad, I never want to see you in the woods again without that hat!"

Are you an employer? Do all of your people wear the safety equipment needed for their job? Do you provide it, or insist that each person, including subcontractors, provide their own? Even if you are not sufficiently concerned for your employees and their families to ensure that the safest working practices, tools, and equipment are used, recognize that safety pays – accidents cost time and money.

Are you an employee? Are you a professional? Do you want to be a top hand, setting a good example for others, or do you think an occasional "vacation" to recover from an injury is part of life? What kind of example do you set for your kids, and what kind of security do you provide for them?

Are you a forester? What kind of example do you set for others? Ball caps have their place – on the ball field. If you are a professional, no matter what your job, you set an example for others by using safety clothing and safe working practices. And if your employer doesn't set the standard, you should. You owe it to your family – if for no other reason.

What is the cost of safety? How much does a belt and first aid kit for a chainsaw operator cost? How does that compare with the loss of production when they cut themselves and walk – if they can – to the landing for a band-aid in the pickup.

What happens when someone is injured in the woods?

1) Lost production while they are treated and away from work.

2) Lost production by other workers and machines who depend on them. An injured chain saw operator may tie up a skidder loader and truck that depend on their production.

3) Lost production by those who help the injured person.

4) Less production by those who saw/heard of the accident and are concerned about it.

5) Less production by the injured employee until they regains their confidence.

6) The supervisor's time to find and train someone else to do the work, the cost of the new person's lower production, and its effects on other operations.

7) The time needed to file all of the accident investigation and insurance forms.

8) The ill will toward an employer or employee who is not safety conscious.

The preceding section cited a survey of employees, which indicated that often factors related to employee needs, the top three – ahead of wages and benefits – were:

1) Appreciation of work done.

2) Feeling "in" on things.

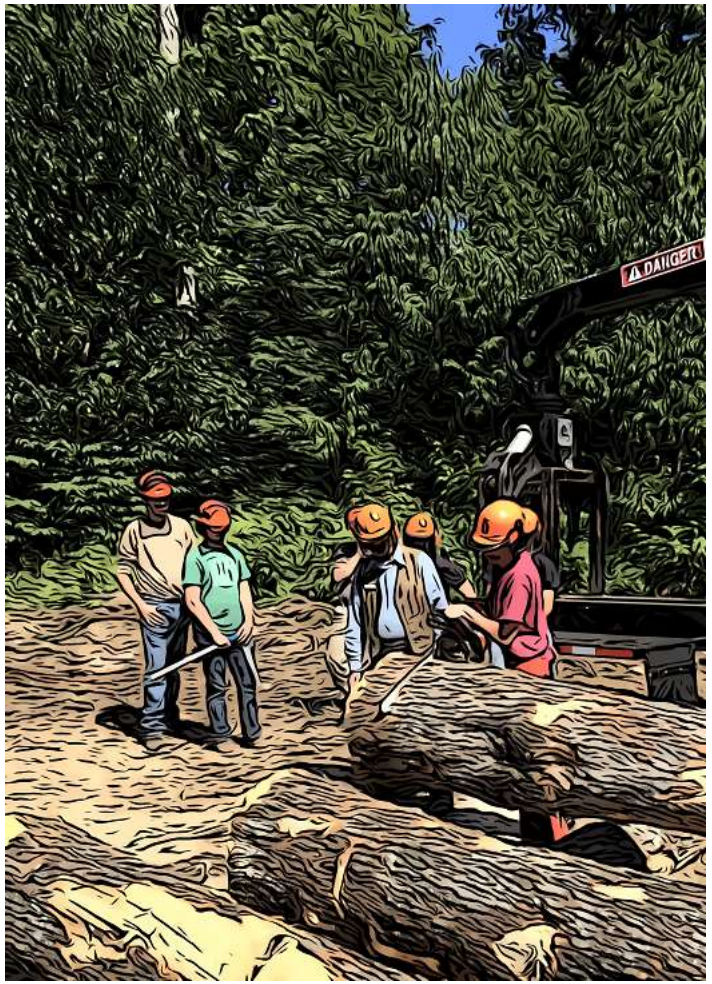
3) Help with personal problems.

To attract and keep employees who will produce for you and stay with you, you must take a genuine interest in their welfare. That interest begins with, and is demonstrated by, your attitude toward their safety. If you are an employer, get with it. If you are an employee, you might look for a considerate employer. But, if your appearance and manner are professional and display a concern for safety, your present work will be safer, your boss will be influenced (and may reward you), and your employment opportunities will be greatly improved. Every boss wants safe workers.

Safety is an attitude, and a commitment. It means wearing the proper gear when it is needed, regardless of what others say. Macho is out.

Training Woodsworkers

One of the toughest jobs I ever faced was training the people who worked for me. To ease this problem, I always tried to hire experienced workers, but this created other problems. Many had learned the wrong habits. Tree-length logging was new and it was tough to find an experienced cutter to fall directionally so the skidder could bunch the wood more easily. One cutter firmly believed in lean gasoline/oil mixtures, and his belief cost me two chainsaws. One refused to wear his hard hat –which I bought – until after he spent a week in the hospital because of a widowmaker. One used a four-foot stick to measure logs – marking with an axe and occasionally nipping a bit off the end of the stick. When a load of softwood logs had several 16-foot logs cut back to 14 feet because they were only 15'10" long, we cut a new stick (logger tapes weren't around then). One guy got tired of cutting marked trees and took some that weren't painted. One drove the skidder too fast, struck a tree at the landing and a big limb fell squarely across the hood of my new log truck. There are thousands more stories like these, and all loggers have experienced this form of frustration in one way or another. Training people is a difficult problem. In any other business, the workers are usually limited to a small area that is easily supervised. But in logging, people are all over the sapworks, and it is difficult to spot their problems and help them. One point I must make – though I could not be there to solve every problem, and probably would have done it another way – every problem was solved by my employees, and solved well. That's a testimony to the ingenuity of those who work in the woods. There just is no other group like loggers.



Training is a necessary expense in time and materials, but training programs like this one are available to help out logging contractors.

Training is an expense in time and materials. Large companies provide both formal and "apprentice" training, plus on-the-job training (OJT). The small business, unfortunately, often cannot provide this opportunity. When you need a new skidder driver, you need someone to work today, not spend a week learning before doing productive work. Often this means the "boss" fills in to train a new person and maintain some semblance of production. Meanwhile, supervisory duties slip, and the supervisor finds himself working nights and weekends.

Logging uses a lot of OJT and this is not good. Recently I visited several landings and was reminded that you can tell a lot from looking at tree butts. Most undercuts went halfway through – twice the needed depth and about 17 percent more work per tree. Six fallers were each cutting about 300 trees/day. If smaller notches enabled each to cut another 51 trees with the same effort, five workers could almost meet the quota instead of six.

What scared me was that undercuts and backcuts were at the same level and most notches were about 30 degrees, so the holding wood broke when the tree was about 1/3 of the way down. That may explain the many fatalities among hand fallers in that area. Most of these men learned to fall by going out with a chainsaw and doing it. After a year of OJT, they were experienced fallers with high production rates. But they worked too hard and were living dangerously. How do you train people under these conditions? There were no training programs available to them and not enough cutters within 300 miles to warrant a Soren Eriksson (*Game of Logging*) workshop. Who would pay for it? I did the next best thing and bought the Swedish logging trainer's videos. Showing your workers training videos is a good idea, and you can probably get your hands on a video series by contacting your local logging association, heavy equipment dealer, or chain saw distributor. But videos alone do not make an adequate training program. So how does the small contractor train the crew? Trade shows are good places to begin. In two days, you can attend several seminars and workshops, see educational displays, and watch demonstrations of new equipment and techniques. Best of all, you can meet and talk with others who are in the same business, compare notes, and get new ideas.

Fortunately, associations are now offering more training opportunities for members. Back home there are other opportunities. The Extension Forester of the Cooperative Extension Service (CES) at your state land-grant university has many helpful publications, presentations, and videos about logging to help you and your employees. Most are free. CES can help you find other publications and videos that might be helpful. In many states, CES has a Timber Harvesting Specialist who might visit your operation or put on a workshop for your crew or a group of crews. CES is usually involved with state and local logging groups and industries and sponsors workshops and field days in logging and logging safety.

There are many regional, state, and local associations involved in forestry that offer training opportunities. Find out which ones are functioning in your area and become a supporting member. NELA and other groups work through

many of them to help financially, avoid duplication of effort, and serve as many people as possible.

Dealers too are an excellent source of training materials and films. My saw dealer held periodic evening workshops on saw safety and maintenance, with refreshments and a chance for discussion and fellowship afterward. My equipment dealer did the same, often with a factory rep to give the lowdown on new equipment and options. You can learn a lot from these meetings.

Another source of training is a small number of trainers, like the late Soren Eriksson and the trainers in the *Game of Logging* program he set in motion, who operate on a consulting basis. They charge anywhere from several hundred to nearly one thousand dollars a day, plus expenses, to train your crew. Most schedule training in any area to minimize travel and expenses for each client, but that means several months of lead time. Don't call today for next week.

So there are workshops, seminars, videos, publications, newsletters, and professional trainers – how can you take advantage of them? First, not everyone in your organization needs to attend every workshop that is offered. The boss should go to as many as possible and take a different employee each time – it really boosts morale and loyalty. Then two people on the crew receive the training and can pass it on to the others. If you are active in any of these associations, you will find that many of the larger mills even pay part of the expenses or some of their suppliers to encourage their attendance at such meetings.

As you become aware of the opportunities open to you, take advantage of their training materials to update your crew. Start with a regular weekly meeting – a "tailgate" session on one day each week. Present appropriate material that you have seen and arrange for others to teach what they have learned. In slow periods, set aside a day for more formal training and arrange for any available "free" trainers to help you out. Take advantage of any available free workshops for yourself and appropriate workers. If you are active in an association – or any kind – lobby for the training that you feel is needed. This is the only way to get your view across. Associations bring the strength of numbers and the funds to sponsor good training sessions by professionals. Is there a vocational forestry program near you? Help the instructor and let them help you; hire some of the graduates, let them help train others.

Many loggers like the freedom of working in small groups, in the outdoors, in rather sparsely populated areas. They don't have the "benefits" of formal training opportunities or facilities of the more urban areas – nor do they have the problems. Training their workers will take the same ingenuity that logging requires. The raw materials are available, but each logger must find out what they are and then make maximum use of them to meet their particular needs.

Are you willing to help teach others? Do you have workers who could help teach others? Do you and other loggers in your area share the same problems? Do you help each other? Have you volunteered to teach others? Are you part of the problem, or part of the solution? If you aren't active, don't complain. Better yet, be part of the solution.

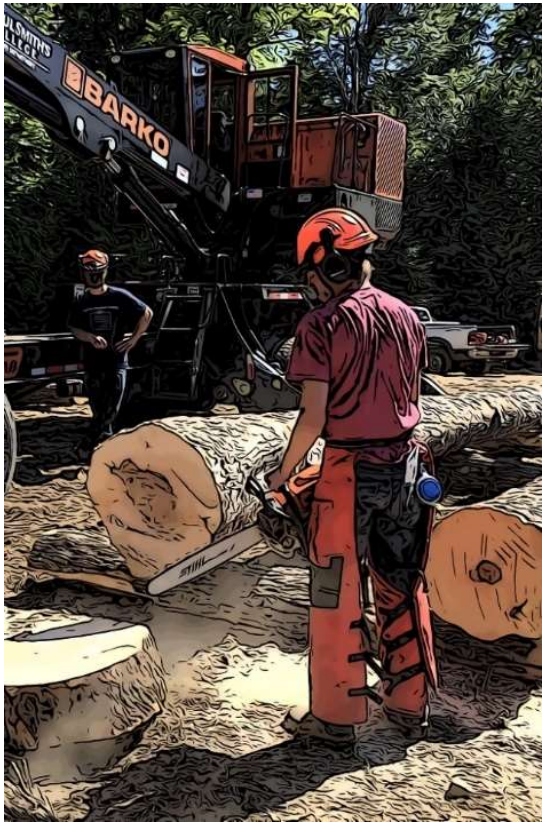
Analyze Your Labor Costs

Two of the greatest resources available in the rural areas of the eastern United States are people and forests. Over the decades both have been abused and tremendously underutilized. Despite mechanization, logging still depends heavily upon people. Because of problems caused by people and shortages of skilled workers, mechanization is increasingly becoming the way to realize higher profits. But, it is expensive to replace a person in the woods — close to $100,000 to replace a person with a used machine and far more for a new one. When a person doesn't work, you don't pay them, but the bank demands payment for the machine whether it works or not.

One of the problems with mechanization is assuring a supply of wood and good markets. In areas where large corporate forest owners supply major mills, mills depend upon loggers and encourage them (sometimes financially) in developing their businesses, including mechanizing. In the areas of small ownerships — farms and woodlots — logging chances and small mills are usually fairly small and markets may fluctuate. A logger has to think twice about mechanizing. And in these areas too, they usually face more competition for labor.

All loggers are looking for "a few good men" (the Marines stole that line from us). Because of low wages the often seasonal nature of woods work and the hard, dangerous, physical work involved not to mention often unpleasant working conditions and lost time caused by weather and breakdowns, logging contractors have a tough time attracting good workers. Unless you offer benefits such as vacation, health insurance, and other incentives, it is even harder to keep good people. Logging is not an easy life.

Assuming that you find and want to hire a good woods worker, how much will you have to pay? If you offer this person $20.00 per hour, is that how much having him on the payroll will cost? No.



Despite mechanization, logging still depends heavily upon people; probably half the cost of logging is labor.

Depending upon what benefits you offer, you should figure on shelling out $40-43 per hour for the average $20 per hour job. Let's look at just how much extra you will have to pay for every $100 in payroll. The values used are based on generalized current rates (2024).

COST OF LABOR

Wages $100.00

Taxes

State unemployment compensation

(1.8-6.5%,)..... $3.00

Federal unemployment compensation

(0.6% after credits for on time payment) $0.60

Social security (FICA)

(7.15%) $7.15

Insurance

Workers' compensation

(30% as an example; rates vary) $30.00

Subtotal wages, required taxes, insurance **$140.75**

Note: So far, we have listed only wages and the taxes and insurance required by law. Already, $100.00 in wages has cost us $140.75!

Supervision

Assume one supervisor per 7 people to plan, lay out, and supervise work at 1.5 times the regular labor rate ($100.00) plus taxes ($40.75), or $211.42, divided by 7 employees $30.16

Administration

Accounting payroll, keeping government records. Probably 5% of cost of labor and supervision (.05 X $170.91) $8.55

Subtotal cost of labor excluding benefits and any return to employer **$179.46**

Fringe benefits

Cost of vacation, employer portion of health insurance, – estimate 20% of basic wages …… …..... $20.00

TOTAL …….. **$199.46**

Profit

Entrepreneur's gain(compensation for all the hassle)say 10 percent of the total margin for profit and risk $19.95

GRAND TOTAL **$219.41**

After going through this list, you might have noted that state and federal withholding taxes are not included, and that is right. These taxes are not a cost to the employer but are deducted from the employee's wages. Also, when the FICA (social security) tax was 7.15 percent, you were paying 14.3, and that is right. But half of the 14.3 percent was deducted from wages and only half was a cost to you. As you go through the list there are five basic classes of costs: wages, required taxes and insurance, overhead (supervision and administration), benefits, and a margin for profit and loss. Wages and required taxes and insurance are absolute minimum out-of-pocket costs. Even if you do all of the supervision and administration (or your spouse keeps the books) and don't leave a margin for profit and loss, you must pay these. If you are the supervisor and don't pay someone else, you should at least earn the super's pay for yourself. And to protect yourself against possible losses, you should leave a margin for profit and risk. Employee benefits is an area more employers should consider. $1.00 in benefits is worth at least $1.22 to an employee, and even more to the employer! Most benefits are not taxable to the employee or included in the employer's taxable payroll. If you give an employee $100 worth of health insurance instead of a $100 raise you do not pay your normal required taxes and insurance on the benefit. And the employee in most cases does not pay $22-25 per $100 for FICA and withholding taxes. Thus, the employee gets a full $100 in benefits and you save in additional taxes and insurance. Similar savings can be made by contributing to an employee retirement plan; today's IRAs are an attractive benefit to workers. Check with your attorney or accountant before setting up benefit programs. There is another group of costs related to labor that we haven't even mentioned. How about the cost of training, transportation, tools, etc.? Every time you hire a new worker you pay those hidden costs of training when you "break them in." During this period, production and quality may be down, equipment wear/tear/breakage may be up, and you or your supervisor may be prevented from doing other work. It pays to 1) hire good people, 2) train them well, and 3) keep them happy.

Chapter Three

Marketing

Marketing & Utilization are Key

Marketing is a major problem in all businesses, of course, and though specifics may differ for logs and lumber, the reasons behind the success or failure of all small businesses are pretty much the same. But all loggers may not have the same opportunities. Each state forestry organization has a Utilization and Marketing Forester whose primary duty is to maintain a directory of wood products manufacturers in the state. This is updated and published annually, complete with a list of primary products (logs, bolts, chips) purchased and products (veneer, plywood, lumber, paper pulp, etc.) manufactured. This is a valuable resource for independent loggers who buy stumpage.

Many loggers produce one or two products for delivery to a few mills. There may even be a financial relationship between operator and mill resulting in interdependence, loyalty, and preferential treatment. There is nothing wrong with this, but diversifying products and markets can be more profitable than dealing with one mill exclusively. Spreading your business around may also reduce overall production because of extra sorting, storage, and smaller truckloads. This does complicate logging, however, and many loggers prefer to keep life simple.

Diversification in log marketing also calls for knowing something about all local mills, their products, and log specifications, and keeping current on changes in their business. Gathering and using all this information requires extra time and effort by the logger, who may find it far easier to deliver woods-run loads to one or two mills – familiar faces whose price and scaling practices are known quantities. But keeping tabs on a number of different markets and working to fill their specific "niche" needs has the potential of earning the logger a lot more money for his wood, time, and effort.

A logger's objective should not be to produce a set volume of sawlogs or pulpwood each week but to convert trees into their most profitable products. At the same time, each tree should be utilized as fully as possible to stretch the resource. One of the topics commonly addressed when discussing sawmill management is "niche" marketing. Most small businesses have to depend to some degree on filling the needs of smaller or specialty markets – in other words, finding and serving the needs of a "niche." The more diversified a logger keeps his product mix, the less likely he is to be hurt by market fluctuations.

Understanding log grading is an important element of marketing and utilization.

Intensive marketing enables loggers to produce more valuable products and use more of each tree. The best place to start is the current state directory of wood products manufacturers. Then visit the mills in your area to find out what they're looking for and talk wood specifications and prices. Take time to understand the needs and manufacturing processes of your potential customers – maybe you can change the way you work to more closely meet the needs of a new market for a better price and/or demand. Mills change, so keep in touch with your contact at the mill and be prepared to respond to changing needs.

As an example of how diversification can help, I once bought a small mud-season sale from the county forester. The estimated volume was 39,000 board feet. Careful marketing and utilization yielded 51,000 board feet for 13 different mills, not counting log-length firewood for a nearby motel. So, how did that affect my productivity and cost? Certainly, the added sorting and handling cost more, but adding this cost to acquire, plan, and lay out the job and develop landings and trails, when spread over 51 MBF instead of 39 MBF, cost about 22 percent less per MBF overall. On a larger sale, this could be a significant savings, possibly the difference between profit and loss on low-valued products such as pulpwood or biomass. But the major benefit was more income for the landowner and a cleaner job site – his pleasure improved my reputation and brought me more stumpage at lower prices.

What's the first step? Begin by contacting the Utilization and Marketing Forester with your state forestry agency and order the current directory of manufacturers. Then, start doing some research on potential new customers for your logs. This involves more than just calling them up and requesting a price/spec sheet. Talk to other loggers if you can and ask them about their experiences with a particular mill. Do they pay on time? How is their scale? How do they feel about buying sorted logs vs. woods-run material, and so on?

If you can't get what you think is an unbiased, objective opinion about a particular mill, take a run out to the operation and do a "drive-by assessment." Does it have a log yard full of logs and not much lumber laying around? Does it appear to be a neat, orderly operation? A yard full of logs could be a good indication that the mill has a good relationship with its log suppliers – i.e., pays on time and runs a fair scale stick. Low lumber inventories may indicate a company whose product is in high demand – quality lumber from a quality operation.

Is the mill hurting for logs, on the other hand, and choking on lumber waiting to be shipped? Does it look more like a train wreck than a thriving business? If the mill has trouble getting logs, there may be a good reason that you should know about before you ship anything to the yard. If it has a hard time moving its lumber, by the same token, you should dig a little deeper before you pursue a business relationship.

Despite opposition by some to the idea of selling raw logs overseas, the export market is another one to consider. Exporting does tend to keep log prices high because of increased competition, and the income you receive helps offset the national trade deficit. Pressures on the tropical

forest resource have increased in recent years, resulting in restrictions on the sale of tropical logs. This, in turn, has created a heightened demand for temperate hardwoods and forests that are managed on a sustained yield basis. The result has been new marketing opportunities for temperate forest products.

Loggers may find that by selling internationally, they can improve economies of scale in production, marketing, and distribution. As a result, the exporter can spread fixed costs over more products, which reduces the costs of production and increases profits. The export market can also provide a profitable outlet for slack capacity.

Loggers entering the export market in a serious way should be prepared to support that market for the long run. Many foreign buyers are looking for long-term relationships and should not be seen as an outlet only when the domestic market has gone soft. Getting into the export market may be well worth the effort despite its initial complexities.

Some loggers choose to enter the export market by selling to another company or broker who then sells the logs abroad. This method of breaking into the world marketplace is the easiest and minimizes the difference between foreign and domestic sales.

As direct involvement in exporting increases, effort and investment of time and money increase, but so do the opportunities for higher profits. Direct exporting involves understanding the foreign buyer's needs and tastes as well as different, more complex channels of distribution. Communications become more important because of greater distances, different time zones, languages, and customs. Business practices, taxes, government regulations, laws, currency, and transportation systems are different because of distance and international borders. Credit terms, financing needs, and collection times are also different. Payment often takes longer because of longer time required for shipping or because of currency exchange problems in some countries.

Foreign market specifications often differ from our normal experience. Sizes, both length and diameter, vary from North American practice. Classification of defects may be more stringent or loose than our practices — a knot may not be a knot. Scaling practices may also vary. In the Pacific Northwest, using Scribner rule for logs 25 to 37 feet long means the buyer gains much on taper. Scribner is often called the "tube scale" because most versions ignore taper, which in some species may be 15 percent of the volume. Be sure to communicate clearly and to minimize potential problems, get it in writing!

There are obviously real costs and risks associated with direct exporting. Yet the costs and risks can be less than selling domestically and, more importantly, profits can be higher. Aid is available from many sources to help overcome some of the initial apprehension. For instance, the U.S. Department of Commerce International Trade Administration (ITA) helps to identify potential markets and will provide information on these markets.

For hardwood producers, the American Hardwood Export Council (www. AHEC.org) is the leading international trade

association for the U.S. hardwood industry. Export information is also available from the state Departments of Commerce or Economic Development and state and regional forestry associations. Trade leads are also available from the United States Department of Agriculture.

Log Marketing Nuts & Bolts

Marketing logs can be a full-time job. Bucking at the landing, loading, and hauling was a good combination for me when I was in the logging business. Sometimes though I would use a full-time log truck driver, and I made a point of riding with him regularly just to stay in touch with the needs of the mills who bought my logs. This way procurement, grading, bucking, and marketing were always under my direct control. Even though most of my stumpage was poorer quality timber from marked woodlots, my log receipts averaged 20 percent higher than other loggers. Low volumes per acre of marked timber cut my production and raised costs –marketing was the only way to survive.

Intensive marketing is not possible in many locations. In parts of Maine and the Lake States, the proportions of softwoods and aspen do not offer much variety in products. Softwood goes for dimension lumber or pulp and aspen goes for pulp. I recently saw this in British Columbia: two softwood mills, both owned by the same company. One sawed logs under 14 inches for studs, the other sawed larger logs for dimension lumber. Aspen markets – waferboard and disposable chopsticks –were beyond economic trucking range.

Then a small local mill needed special lengths – 9, 12, and 13-foot spruce with one inch of trim. We scratched his back so he scratched ours and bought two trailer loads of large aspen trees standing next to our road. We simply felled, limbed and bucked the trees, then drove the truck in and loaded them. This points out the value of flexibility and a willingness to offer service. The key was a truck-trailer with self-mounted loader, and that was the key to my operation years ago in Vermont, as well.

The care involved in trimming and preparing logs is important to mill operator, and the quality of logs reflects on the professionalism of the logger.

A major factor in using a truck-mounted loader is that it cuts payload capacity by about a cord (500 board feet). But the big plus is the ability to pick up return loads and run loaded both ways. Unlike some parts of the country, southern New England still has many small operators with a chainsaw and skidder who hire their trucking. My truck-mounted loader was a big hit with loggers like this who wanted to "pay" me to haul logs for them, but collecting my money after the logs

were hauled turned out to be a big problem. The easy way would have been to beg off, but the profitable solution turned out to be buying those logs to boost my sales – hauling my logs instead of someone else's.

Marketing is many things, but one important aspect is service. I developed a reputation for delivering specialyy logs on short notice. Hard-to-market species such as hemlock and elm were often left at the landing in tree-length form. When someone needed planks for a bridge or horse barn, my phone rang and in a few days the logs were delivered, cut to the desired lengths. If I didn't have the logs, a friend did.

Service is a two-way street. Those who you help will usually help you. Many mills will not buy maple butts with tap-holes, but one small mill I did business with would gamble on them. Rather than leave 4-5 feet of maple butt in the woods, the 8-foot butt logs went to this mill. One mountainside had some beautiful, veneer-quality yellow birch, but the butt 5-6 feet had excessive sweep. Fortunately, some short-log mills paid premium prices for them, cutting them into 24 to 30-inch bolts to avoid the problems caused by sweep.

How do you handle small quantities of specialty products? If the weather is favorable, the volume adequate, and the access good, leave tree lengths or logs at the landing and pick them up when convenient. Or drop odd logs at a convenient storage point until there is a full load. If spoilage is likely, deliver part of a load to one mill, the rest to another. Deliver small loads if the value is high enough and the haul distance short. I even occasionally paid someone to saw my logs into lumber and then sold it to cabinet makers. If you have a nice supply of specialty logs and a lumber buyer, it may pay to saw them with a portable band sawmill.

One traditional problem with sawmills is the question of grade – specifically the lack of standard grades. Some mills have written specs but others use vague generalities that may vary from week to week. This encourages loggers to sell woods-run for the highest average price and the best scale. But if you buy stumpage based on mill receipts, the higher the scale the more stumpage you pay. Grading might be to your advantage.

Another question arises when logs are sorted, especially when veneer is pulled out. If log specs are well written and the price is fair, mills get what they pay for, but the best grades produce the most manufacturing profit.Nobody likes to have the cream removed. If you pull out the best for veneer, find a buyer for the low end and sell the middle logs to sawmills that buy on grade. Never pull veneer on a mill that buys woods-run – it's not only unfair but will doom your chances of continued business with that mill when the log buyer (inevitably) catches on.

If you practice intensive marketing and sell on grade, try buying stumpage based on grade recovery. This takes some of the guesswork out of appraising timber and is fair to all concerned. Stumpage value might be based on a basic rate for logging plus a percentage of the mill price, or product value, such as logs waferboard, fuelwood, biomass, etc.

One consideration in product sorting is the technical specs regarding diameter, length, trim, knot size and placement, scars, rot, etc. Most sawmills buy lengths in two-foot intervals, but hardwood lumber is also sold in odd lengths and many mills will buy odd lengths. This is especially helpful for increasing recovery of hardwood trees that are often characterized by crook, forks, and large branches.

Length is a major factor in lumber prices. A 14-foot hardwood log with a limb in one end, for example, may be worth much more to the mill than a clear 12 or 13-foot log, though log specs may say otherwise. This is where a good understanding between logger and mill owner can be beneficial to both. A logger who makes an effort to better satisfy the mill will receive favored treatment in many ways. With all of the natural and social problems facing us, we need to work together at every opportunity.

The care involved in trimming and preparing logs is important to mill operators, and the quality of logs reflects on the professionalism of the logger. Branch stubs cause problems for electronic scanners, producing false diameter readings that can totally foul up the computer controlling the head saw(s). Hinge wood and splinters projecting from tree butts may hit stops on log conveyors, producing short logs and extra waste. Take time to visit the mills you supply and use what you learn to make their work easier.

One of the problems of intensive marketing is serving seasonal and intermittent buyers who may not be able to do all they claim. Unusual opportunities – special orders for particular species and grades – often produce entrepreneurs with good intentions but doubtful ability, and sometimes questionable integrity.

I once had a pole and piling contract canceled before I could even buy the stumpage. Fortunately, I only lost the time invested in finding and cruising a lot – much less than if I had paid a high price for stumpage and then lost the market. In one of the Japanese bowling alley crazes, a large out-of-state outfit came looking for red maple at fantastic prices, only to back down when pressed for a contract. The road to hell is paved with good intentions, and lined with cheats and jerks.

Finally, know the organization with which you are doing business. The world has changed, and written contracts are only as good as the integrity of the people who sign them. There is nothing magic about a contract, it is simply a written understanding that is no better than the faith of the parties to it.

Chapter Four

Production and Cost Records

The Meaning of Costs

2024 Note: This article draws heavily on a 1986 USDA Forest Service Publication and so has not been updated in any way. Despite the dated references and cost figures, the story it tells remains instructive.

Ask the logger with a brand-new cable skidder why they didn't buy a grapple instead. Chances are he'll tell you the grapple costs too much. Does it? List price for a 130 HP cable skidder might be $89,000, and the same model with a grapple may cost $130,000. Certainly, the price of the grapple model in this example is $41,000 more, but does it really cost more? The grapple skidder does cost more, in several ways:

1. The purchase price is higher

2. The monthly payments are higher

3. Daily ownership costs are higher

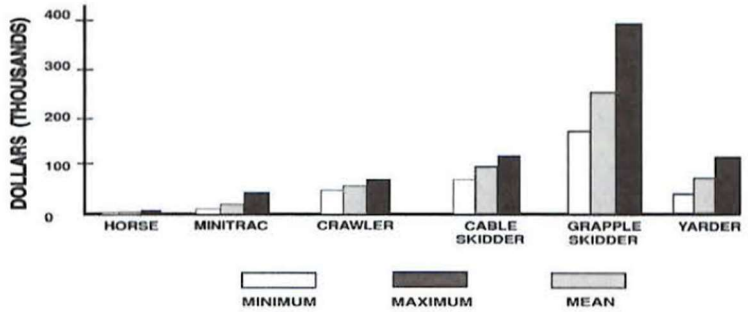
Most mills don't care about purchase price, monthly payments, or daily ownership costs – they're concerned about the cost per thousand board feet or cord of wood delivered to them for processing – the Cost Per Unit. The cost per unit of the skidder is approximately:

1. Purchase price (plus interest taxes, insurance) divided by the number of units skidded over the life of the skidder or

2. Monthly payments (with allowances for insurance and taxes) divided by the number of units skidded in a month or

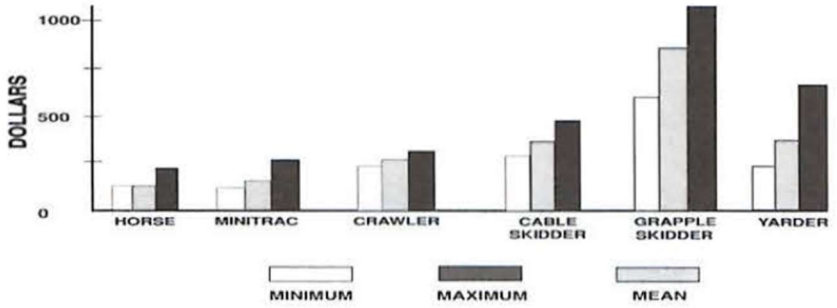
3. Daily ownership costs divided by the number of units skidded per day.

Figure 1: Capital Cost of Equipment



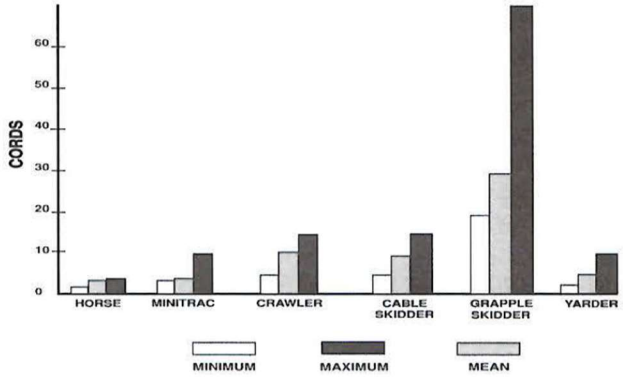
All three of the above should be about the same. The difference in cost per unit between cable and grapple skidders depends upon their productivity. A grapple skidder may cost half again as much as a cable model, but if it moves twice as much wood per day, its cost per unit will be less. Your income is based on a price per unit, so know your costs on that basis.

Figure 2: Logging System Cost Per Day



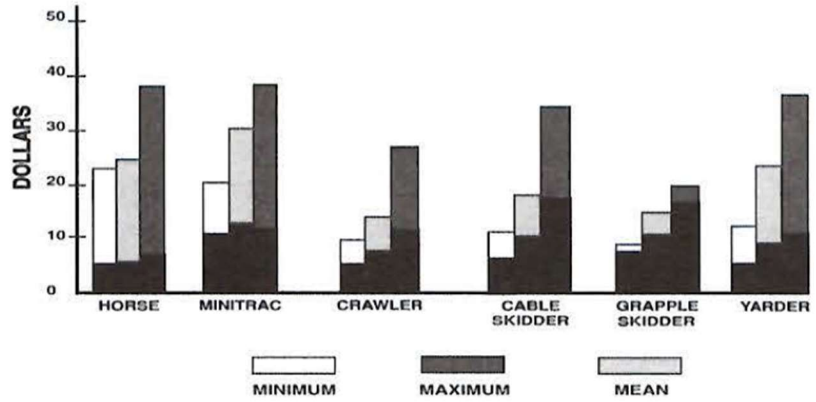
An interesting paper by the U.S. Forest Service (Sarles and Luppold 1986) details cost relationships for seven harvesting systems. Four bar graphs of the six systems used in our region are shown here. The first, capital cost of equipment, shows a range from $4,000 for a horse to about $264,000 for a mechanical operation. Which costs the least? The horse, obviously. The second graph shows logging system cost per day. Again, the horse comes out best. But look at daily production – production rate per man day – the feller-buncher and grapple skidder are way out front. But now, look at logging system cost per cord – the grapple skidder is lowest and will have the best profit margin. All four graphs show three values for each system – lowest, highest, and mean (average). Now look at the cost per cord again. The upper, shaded part represents labor and the solid black area is capital and operating expenses. Mechanization does one thing – it cuts labor and boosts productivity greatly, and as such is the lowest cost method.

Figure 3: Production Rate Per Man Day



Do one more thing – draw a straight line across the graph at the $20.00 level. If the price to harvest wood is pegged at $20.00 per cord, just above the average cable skidder cost, skidders will pay. Even crawlers pay because skidding distances were about half those for skidders, and some West Coast logs were included. But the logger with a horse or mini-tractor will not make it but can pay operating costs and work longer hours earning a substandard wage. Wages (1983 data) work out to about $4.00/hour for the horse logger, $3.00 for the mini-tractor logger, and $6.00 for the rest. Also, all skidders don't show a profit. Those with better than average operators – the right equipment, well-maintained, and good labor working efficiently – do well. But poor managers have higher labor costs. You must pay the operating costs – machines, fuel, etc. – so if they are too high, there is not enough to pay all labor costs.

Figure 4: Logging System Cost Per Cord



The point is, if you cannot "afford" to buy the equipment to do the job efficiently, your unit costs may be too high to be competitive. The situation varies with each operator depending upon the age and condition of his equipment, the timber and terrain conditions, and management skill. Grapple skidders are far more efficient than cable machines in flat terrain with bunched wood. On steep hillsides, cable skidders are safer.

In the final analysis, you must analyze your situation and choose tools that best fit your conditions. Just be sure to consider all the facts.

Literature cited:

Sarles R. L. and W. G. Luppold. 1986. "Technoeconomic Analysis of Conventional Logging Systems Operating from Stump to Landing." USDA Forest Service Publications Group, Northeastern Forest Experiment Station, 359 Main Rd., Delaware, OH 43015. Request Research Paper NE-577.

Know Your Costs

In terms of profits, it seems the logger is always caught between a rock and a hard place. The landowner insists on top dollar for his wood, while the mill pays as little as it can to get it. The question then arises, "How can you pay more, sell for less, and increase profits?" The answer, of course, is that you can't, but you should know your costs well enough to know what you can afford to pay for stumpage and what you need to get for that wood at the mill gate. Most loggers have an idea, week to week, how they are doing financially, but they often find over a period of years that they are falling farther and farther behind. The hints included in this chapter are aimed at helping loggers better determine their costs and then finding ways to improve production and profit.

Being the middleman between the landowner and the mill forces the logger to think in terms of cutting costs first, but many loggers will find that it doesn't hurt to think in terms of profits at the same time. Sometimes spending a little more can produce a lot more, so the best advice I can give is to be conscious of costs, cut them when and where you can, but think first in terms of increasing profits.

Cost control and profit improvement require that loggers have a good handle on their costs – what they are and how much they are. They must also have a good feel for time and production, because then they can determine production per hour/day/week and cost per cord/board foot/ton. Can you imagine buying wood by the cubic foot, paying your crew by the cord, and selling by the ton? You can never quite be sure whether your operation is efficient or if the conversion factors are incorrect.

This section and the ones that follow will examine methods of analyzing logging operations in order to find ways to cut costs, raise productivity, and improve profits. It will range from very simple studies of organization and methods of work (next) through detailed time studies. Since the first method doesn't put number values on work, and the second is too expensive for most loggers, we'll concentrate on a middle-of-the-road approach, gross time study.

Form 1A: Record of Income

Line (1)	Date (2)	Income Red'd From (3)	Type of Work (4)	Amount (5)	Code (6)
1	5	Northeast Pulp Co.	78 Cords pulp @ $30/cord	$2,340	1.1
2	12	Same	69 Cords pulp @ $30/cord	$2,070	1.1
3	19	Same	92 Cords pulp @ $30/cord	$2,760	1.1
4	26	Same	74 Cords pulp @ $30/cord	$2,220	1.1
5	9/2	Same	60 Cords (for del. thru 8/3	$1,800	1.1
6	9/2	Jackson Lumber Co.	32 MBF sawlogs del. thru 8/3	$3,200	1.2
			Woodlot Code Buyer Code		

Gross time studies measure the production of a particular machine or system over a period of time, usually a week, and based on production (scale slips), you can estimate productivity (production per hour) and costs (both hourly and per unit of production). Most of us do this mentally, rarely bothering to write it down. When we have a bad week, we may not know exactly why, but we have a general idea. When this happens, we usually forget it, counting on next week to be better. Loggers have to be optimistic. If next week isn't any better, we have a problem. How do we dig out the answer?

Form 1: Record of Money Paid Out

Line (1)	Date (2)	Check (3)	Money Paid To (4)	Amt. Paid (5)	Code No. (6)
1	3	210	Jones Fuel - 100 gal.diesel		
2			- 24 qt. motor oil		
3			- 1 gal. hyd. oil	742.36	2
4	3	211	D&D Ins. Co. - truck ins.	375.00	22.1
5	4	212	J. Blow, cutter - 1 wk. wages	416.32	5.3
6	4	213	N. Jones, Skidder - 1 wk. pay	437.56	5.1
7	4	214	T. Conway, Trucker - 1 wk pay	437.56	5.2
8	4	215	Self, 1 wk. pay	502.87	6.0
9	5	216	B.K. Tire, 2 10-ply truck	450.00	4.1
10	11	217	J. Blow, cutter - 1 wk. pay	365.40	5.3
11	11	218	N. Jones, Skidder - 1 wk. pay	437.56	5.1
12	11	219	T. Conway, Trucker - 1 wk pay	437.56	5.2
13	11	220	Self, 1 wk. pay	502.87	6.0
14	11	221	J. Brown, Contract Trucking	400.00	7.1

Gross time studies tell us whether we're making or losing money, but they don't tell us where, or how much. It is a simple matter to keep good records – but bear in mind that simply collecting check stubs and scale slips isn't good enough anymore. With a record system, it is easy to estimate costs per cord or thousand board feet for cutting, skidding, loading, hauling, and other related costs. If we segregate these costs by job, we can even see how weather, terrain, timber size, and other factors affect production.

Everything begins with a good record-keeping system. There are several commercially available software systems for logging and a number of free mobile apps available from public agencies and forest product industry associations. There are publications on this topic available on the USDA Forest Services website (www.fs.usda.gov) as well as other sources.

The basic records you need are daily expenses and receipts – the date, what the item is, to whom paid/from whom received, and the amount. But, for each expense, be sure to record the activity, i.e., cutting, skidding, or trucking, and the job it is charged to. For each receipt, record the volume sold. You can use this information to estimate the costs of different operations (cutting, skidding) per unit of production. If you keep simple notes about each job, such as the time of year, topography, weather, timber size, etc., you can estimate the effects of timber, ground, and weather conditions on productivity. This helpful information can be collected by your employees. Loading and trucking are easy to track because scale slips show the volume delivered and the date.

In the woods, have the skidder operator keep a daily record of how many trips he made, unusual events (breakdowns, etc.), and trail/terrain conditions. Have the chopper record how many trees he cut, average tree size, and problems he encountered. This information can help relate ground/timber conditions to daily production, which is a real asset when bidding on stumpage or negotiating logging contracts. Simple records like these form the basis of a good cost accounting system, as well as providing the necessary facts for income taxes. From this point on, you can have your accountant manage the records, though you would understand your business better if you were involved. With a desktop computer or even and mobile phone, you can use the data to play games with your operation — see what happens when you cut larger or smaller wood, add a skidder, mechanize, etc. There are good, easy-to-use, inexpensive, or free computer software and mobile apps available for logging analysis.

Loading and trucking are easy to track, because scale slips show the volume delivered and the date.

Simple Business Records

We have already considered the importance of good but simple cost records. Now we will consider only basic expense and income records – the minimum requirements. The simplest way to keep this information is your checkbook; pay all bills by check and have a permanent record. Also, keep a separate checking account for your business – don't use the family checking account. For ease of reference, sample forms 1 (expenses), 1A (income), and 7 (wood deliveries) from the Forest Service cost record booklet are shown below and to the right. These are the minimum records needed. If you have a good record system, stick with it, but you might use some of the following ideas to make it more useful.

Study the sample forms to learn what information is needed; most can be picked from check stubs and scale slips. If you wish, simplify the wood delivery form. Also, review the site information discussed in Chapter Four ("What Is Work?") and make simple production forms similar to those shown there with blanks for workers' names and date.

Form 1A: Record of Income

This form includes details like date, income received from, type of work, amount, code, and so forth. For example, it records sales of cords of pulp to Northeast Pulp Co. at specific prices per cord.

Form 1A: Record of Income

Line (1)	Date (2)	Income Red'd From (3)	Type of Work (4)	Amount (5)	Code (6)
1	5	Northeast Pulp Co.	78 Cords pulp @ $30/cord	$2,340	1.1
2	12	Same	69 Cords pulp @ $30/cord	$2,070	1.1
3	19	Same	92 Cords pulp @ $30/cord	$2,760	1.1
4	26	Same	74 Cords pulp @ $30/cord	$2,220	1.1
5	9/2	Same	60 Cords (for del. thru 8/3	$1,800	1.1
6	9/2	Jackson Lumber Co.	32 MBF sawlogs del. thru 8/3	$3,200	1.2
			Woodlot Code Buyer Code		

Form 1: Record of Money Paid Out

This form is used to track expenses such as fuel purchases, insurance, and wages. It includes the date, check number, money paid to, amount, and a code for each expense.

The forms indicate that each column calls for "codes." Accountants classify and identify expenses such as fuel, wages, etc., with a code number, which makes it easy to prepare financial statements. Eventually, in order to separate cutting and skidding costs, we will need to change the codes used in the example forms. An easy way is to add a

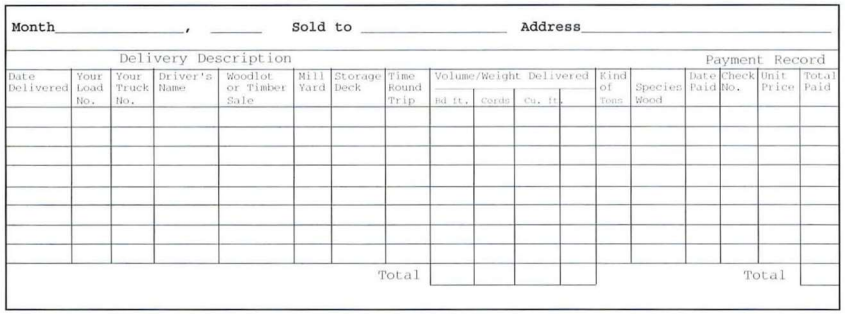
decimal point and number – such as ".1" for cutting and ".2" for skidding – to the standard accounting codes. By using a two-digit code, you can identify up to 10 different woodlots. Note that Form 1A column (6) has a space for woodlot records. If coding is confusing, ask your accountant or read the cost book to clear it up. For now, all you need are expense and income forms similar to those shown and just note the process (cut, skid, etc.) and woodlot on your checks and stubs until you settle on a code system.

Form 1: Record of Money Paid Out

Line (1)	Date (2)	Check (3)	Money Paid To (4)	Amt. Paid (5)	Code No. (6)
1	3	210	Jones Fuel - 100 gal.diesel		
2			- 24 qt. motor oil		
3			- 1 gal. hyd. oil	742.36	2
4	3	211	D&D Ins. Co. - truck ins.	375.00	22.1
5	4	212	J. Blow, cutter - 1 wk. wages	416.32	5.3

The next key record is for wood deliveries (Form 7). By tying wood deliveries (production) to cutting, skidding, and trucking expenses, we can compute the cost-per-cord of these activities. These three forms – expenses, income, and wood deliveries – are the basic record system. This information, combined with daily production records kept by workers, will permit all kinds of analysis. For example, you can link the costs of cutting and skidding with terrain, timber, and weather to guide you in buying stumpage or setting contract rates. Weekly or monthly production and cost records serve as a gross time study which can help you see where problems lie. You can compare current expenses, income, and production with last week, last month, and last year to see what is changing. If sudden changes occur, workers' notes about site conditions may indicate whether breakdowns, labor, terrain, weather, or timber are likely causes. We'll get into the details of this later.

Form 7: Wood Delivery Record


Month_____, _____ Sold to _____ Address_____

Delivery Description														Payment Record			
Date Delivered	Your Load No.	Your Truck No.	Driver's Name	Woodlot or Timber Sale	Mill Yard	Storage Deck	Time Round Trip	Volume/Weight Delivered				Kind of Tons	Species Wood	Date Paid	Check No.	Unit Price	Total Paid
								Bd ft.	Cords	Cu. ft.							
							Total							Total			

We assume that your analysis will be done by computer (either yours or your accountant's – it's the only way to fly). Using your daily records, which are simple and hassle-free, your costs can be segregated byclicking a mouse..

Editor's Note: All the forms shown here are derived from USDA Forest Service Publication NA-FR-29 *An Updated Cost-Record System for a Logging Business* by F.E. Hampf, E.W. Pruett and J.H. Smith. This was a highly recommended, practical guide at the time when this was originally published.

Estimating Machine Rate/Ownership Costs

Labor costs are simple to calculate. When someone works for you, you pay them. But what is the cost of operating a $300,000 machine that is paid for in advance? Industrial engineers and cost accountants use an estimate called machine rate, which we'll look at here, before trying a more logical approach. Machine rate includes ownership costs, which you pay whether you use a machine or not, and operating costs, which is what the machine costs to run. Ownership costs include depreciation, interest, insurance, and taxes; they are sometimes called fixed costs, because they are fixed in time (usually by year). They may also be called indirect costs, because they are not a direct result of work activity. Some people might even consider these to be overhead costs. Operating costs are what you pay for fuel, lube oil and grease, repair, labor, etc., while actually using a machine. Because they are a direct result of work activity, they are often called direct costs. Also, since they are not fixed in time, but vary with production, they are commonly called variable costs.

We will compute both types of costs on an hourly basis. If you know your hourly costs and production, it is easy to compute costs per unit (cord or board foot). Hourly costs can be the basis for setting contract rates.

Ownership Costs

Depreciation is the first cost of ownership. It's the "spending" of the capital investment as the machine wears out. Accountants calculate this in one or several ways for income tax, but we will use the simple straight-line method, as in this equation:

D = ($300,000 - $60,000) / 5 years = $48,000 per year

To arrive at an hourly cost, divide the yearly cost by the number of hours worked per year. Working a machine 40 hours weekly for 52 weeks is 2,080 hours, but a better estimate for logging machinery is 1,700-1,800 hours. This allows time for bad weather, mud season, moving, and planned overhauls. For 1,800 hours, the calculation is:

D = $48,000 / 1,800 hours = $26.67 per hour

You may want to use a different number of hours per year based on your own experience. If you have longer wet seasons and operate your machine only 1,600 hours per year, hourly cost jumps to $30 per hour, but this apparently higher cost may be offset by higher salvage value resulting from less use of your machine. Use values that best fit your situation.

Interest

If you borrow to purchase the skidder, you pay interest. However, machine rate ignores finance charges and considers interest as earnings lost by investing in the machine instead of some sure investment. This is called the "opportunity cost," and currently may be four percent. If useful life is five years, a quick way to estimate average cost per year is to figure interest on the average investment (AVI) with the formula (and using the previously calculated annual depreciation of $48,000):

AVI = ((Purchase - Salvage) x (# of years +1)) + Salvage

= $240,000 + $20,000 = $260,000

To calculate interest, simply multiply the average investment ($260,000) by the interest rate (4 percent is equal to 0.04) and you get $10,400. Beware – this is an estimate, not the actual amount of interest. And before computing interest, two other costs based on a percentage of value can be added in, and all three computed with one calculation.

Insurance and Property Tax

Insurance and property taxes are also based on the average value, so we can add the percentage rates for insurance (from your insurance agent), property taxes (from your local tax assessor, if applicable), and interest and apply all three to the AVI. If interest is 4 percent, insurance 3 percent, and taxes 2 percent, the total rate is 9 percent, and average annual cost is 9 percent (that's 0.09 as a decimal) of AVI or $23,400. On an hourly basis, $23,400/1,800 is $13.00

Total Ownership Costs

Total ownership costs are depreciation (D) plus interest, insurance, and taxes (IIT), or $26.67 plus $13.00 equals $39.67 per hour. This does not include labor, fuel, etc., to operate the machine. Note that costs were averaged over the five-year life while most would be higher the first year and decrease after that. Remember we are estimating these costs. The answer is not precise, but is close. Obviously, when you average costs over five years, there are some problems. Actual interest, taxes, and insurance will be higher in the first year because the investment value is higher, but they will be much lower in the fifth year. Again, this is an estimate. Also, there are costs such as maintenance and repair that are very low the first year and grow as the machine ages. To some extent, these costs balance each other.

Stop and think for a minute about the costs we have just considered – depreciation, interest, insurance, taxes – and remember that they must be paid whether you run the machine or not. Such expenses are classed as fixed, sometimes called indirect costs. They are fixed in time – so much per month. As soon as we turn the starter key, operating costs begin.

Operating costs, which include things like fuel, maintenance, and labor, are different from ownership costs, which occur whether a machine is operated or not.

Estimating Machine Rate/Operating Costs

We have already begun examining machine rate, beginning with ownership costs. Now we will consider the second category of expenses – operating costs. Expenses of ownership are fixed in time, generally on an annual basis (depreciation, interest, insurance, taxes), but converted to hourly costs based on how many hours we plan or schedule to work during the year. Operating costs are incurred only when a machine's engine is turning over – when the machine is producing; call this time productive machine hours (PMH). These costs are not fixed in time but vary with production – hence are often termed variable costs. Since they occur as a direct result of operation, they may also be called direct costs. Finding total costs when some are fixed in time and others are variable presents some problems which we will consider later. For now, let's examine a simple method of estimating operating expenses. The key word is estimate.

Operating Costs

Expenses of running a machine–operating costs–include fuel, lube, filters, grease, maintenance, repair, and labor. (Tire cost can be included but is omitted for simplicity. To include tires, subtract their value from the purchase price and add tires and replacements as a maintenance expense). One method of estimating operating costs is to refer to your records and use actual expenses, based on experience. One problem we may run into, for example, is that we may know how much fuel we have purchased but not know how much was consumed by a particular machine. Also, we normally want average costs over the life of the machine and won't have these until we're ready to trade it. And the new machine is probably more efficient than the old one. So, we estimate. Don't hesitate to modify estimates based on your own experience and judgment.

Fuel= 0.40 x HP x Fuel Cost/gallon x 0.65 engine efficiency / 7.08 x gallons of fuel (diesel)

* 6.08 is used for gasoline

For example, if our $300,000 skidder has 225 horsepower and fuel sells for $4.40 per gallon:

Fuel cost = (0.4)(225)($4.40)(0.65) / 7.08)

= $36.36/hour (PMH)

Simple shortcut formulae for estimating fuel cost are:

Fuel = 0.37 x HP x cost/gallon (diesel)

= 0.43 x HP x cost/gallon s(gasoline)

You may also want to modify some values in the formula. If, for example, you were using a portable winch or farm tractor and winch, you might reduce fuel consumption based on high engine idling time.

Lube and Oil Filters

A simple estimate of grease, lube oil, and filters is 25-35 percent of fuel costs. At 30 percent, these are $10.91/hour (PMH). For a closer estimate, use manufacturer-

recommended service intervals and grease/oil capacities to compute this on an hourly basis.

Maintenance and Repair

Actual maintenance and repair (M&R) costs vary with machine age, usually starting out quite low and climbing as the machine is used. The rate of climb depends on how well equipment is maintained and how carefully it is operated. TLC (tender loving care) keeps costs down. As with other operating costs, past records of one machine may not be suitable for estimating another. You must be the judge. If you don't have records, or want to estimate the cost of a new machine, it is customary to estimate M&R costs as a percentage of depreciation. For crawler tractors, with steel on steel, 100 percent is commonly used. For rubber-tired skidders, 60 percent may be realistic. Much depends on your operating conditions and care in using a machine. In the South, where hot weather means higher operating temperatures, expect maintenance to be much higher. You may need an engine overhaul in three years or less, whereas you may get five or more years in the North.

Labor

Labor is relatively easy to calculate – simply add the cost of wages, taxes, and benefits. If in doubt, refer to the earlier section on labor costs. If you normally lump some of the costs listed in that section into one "overhead" rate, don't add them in twice. In this case, we'll assume labor costs of $40 per scheduled hour, including overhead.

Utilization

Ownership costs are fixed in time while operating costs are variable, occurring only when the machine actually runs. Ownership costs were based on using the skidder for 1,800 scheduled machine hours (SMH) per year, but actual working time (productive machine hours) is less because of repairs, weather, moving, etc. Utilization is the link between SMH and PMH. If the skidder is scheduled for 1800 hours (SMH) but works only 1440 (PMH), it is used only 80 percent of the time. This percentage is the utilization rate. If we know the number of scheduled machine hours and have a rough idea of productive hours from hour meter readings, we can estimate utilization with the formula:

Utilization = (PMH/SMH) x 100%

or we can estimate productive time if we know normal utilization rates:

PMH = SMH x Utilization %

The objective of any well-run operation is to keep utilization rates as high as possible. Ownership costs are scheduled in time, but operating costs occur over a smaller, variable number of productive hours when the engine is actually running. Suppose fuel, grease, oil, filters, etc., cost $10.00 per operating hour (PMH). If utilization is 80 percent, the machine works 80 percent of scheduled time (48 minutes per SMH), hence cost is 80 percent or $8.00 per SMH. If depreciation is $26.67 (previous section) per SMH and we assume M&R for a rubber-tired skidder as 60 percent of depreciation, then M&R is $16.00 per SMH – or $12.80 for

48 minutes of work. But on an operating hour basis (PMH) the machine runs 60 minutes. From the formula above, you may say "PMH is SMH times 80% which is 80 percent of $16.00 or $12.80!" But we're not talking about time, we're talking about costs per unit of time or:

$/PMH - $/SMH / Utilization

or

$/PMH = $12.80/0.8 - $16.00/PMH

If you get confused by algebra, just remember – cost per PMH is always higher than cost per SMH. To decide whether to multiply or divide by utilization, use the method that gives the larger cost for PMH.

Total Cost

We calculate ownership costs on a scheduled hour basis and operating costs on both scheduled and productive-hour bases. How do we add apples and oranges? The easiest way is to convert all to a scheduled basis, using the utilization rate. Depreciation, interest, taxes, insurance, labor, repair, and maintenance costs were calculated per SMH, but fuel and lube must be changed from costs/PMH to costs/SMH. If utilization is 80 percent, costs are:

EXPENSES	$/PMH	$/SMH
Depreciation		**26.67**
IIT		**13.00**
Maintenance and repair		**12.80**
Labor		**40.00**
Fuel	**29.08**	
Lube/filters/grease/oil	**10.91**	
TOTAL	**132.46**	

How, you might ask, if we use $36.36 in fuel per productive hour, do we only use $29.08 in a scheduled hour? Simple. The machine only runs 80 percent of scheduled time or 48 minutes, so it uses 80 percent of the fuel that would be used in 60 minutes. If you wanted an hourly cost for contract work with the machine, you could use the $132.46 figure. Another use for the hourly rate is estimating production costs. If the skidder produces 21 cords per nine-hour shift:

Cost/cord = 9 hours x $132.46/hour / 21 cords = $56.76/cord

For more detail on machine rate, read E.S. Miyata's *Determining fixed and operating costs of logging equipment*." USDA Forest Service Technical Report NC-55 (search the www.fs.usda.gov website for this publication).

Machine rate is widely used by accountants, engineers, and foresters and for large companies, it is a logical method. But, there is a better way for loggers who finance equipment: cash flow analysis. Read the next section to learn about it.

Literature cited:

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Estimating Machine Costs – Cash Flow

We have already considered machine rate as a way to estimate the owning and operating costs of a skidder. While this is a reasonable method for a business that does not buy machines on the installment plan, it underestimates the cost for a company that finances equipment. Depreciation is fine for computing taxes but does not reflect the out-of-pocket costs of ownership. First of all, depreciation is defined as purchase price minus some arbitrary value (20 percent salvage, for example), yet actual cash investment is purchase price less trade-in (or down payment). The capital investment could be much more or less than the depreciation value. Secondly, "useful life" for depreciation, or "using up" the capital cost of the machine, is five years, but skidder payments are spread over three to four years, so out-of-pocket costs are higher than depreciation. Also, interest was computed as the rate earned on a "safe" investment, and finance charges are higher than "safe" rates. Further, interest was based on average value of investment (AVI), which includes salvage. Finance charges are based on the unpaid balance; adding salvage is the same as paying interest on your down payment.

Ownership Costs

The first cost of ownership is monthly payments. You can get these from the dealer or estimate the principal and interest. Principal is calculated in the same way as depreciation:

Principal = purchase price – down payment (and/or trade) / payment period

Normal payments are made monthly, but we'll consider yearly costs, then calculate cost per hour. For the $300,000 skidder, assuming $50,000 trade on your old skidder, paying the balance over 42 months (3.5 years):

Principal - $300,000 - $50,000 / 3.5

Principal = $71,428.57 / year

If you schedule 1800 hours per year:

Principal = $71,428.57 / 1,800 = $39.68 / hour

Remember that depreciation was $26.67/hour; already you can see problems with machine rate. Next, we must calculate interest. The AVI formula, without the salvage value, is a close estimate. If the finance charge is 8 percent APR (Annual Percentage Rate) or 0.08:

Interest = (purchase – down payment)(# of year +1 (rate) / 2 x no. of years)

= ($300,000 - $50,000) (3.5+1)(0.08) / 2 x 3.5)

= $12,857.14/year OR, for 1,800 hours/year = $7.14

Interest in the machine rate calculation was not separated but was computed with insurance and taxes. Insurance and taxes are calculated in the same manner as machine rate, using the AVI ($260,000). If the rates are 3 percent for insurance and 2 percent for taxes:

IT = ($260,000)(0.05)

= $13000/year or $7.22/hour

Total cash ownership costs are the sum of principal ($39.68), interest ($7.14), and insurance and taxes ($7.22), or $54.04 per scheduled machine hour. This is about 36 percent or $14.37/hour higher than the machine rate. When you calculate the difference over 1800 hours, it is $25,866 per year.

Operating Costs

Operating costs are calculated in the same manner for both machine rate and cash flow methods, and depreciation is still the basis for estimating maintenance and repair. So labor ($40.00), maintenance and repair ($12.80), fuel ($39.36), and lube etc. ($10.91) computed for the machine rate are still valid.

Total Costs

Using cash flow ownership and previous operating costs, total expenses per hour, based on 1800 scheduled hours per year and 80 percent utilization, are:

EXPENSES	$/PMH	$/SMH
Principal		**39.68**
Interest		**7.14**
Taxes and Insurance		**7.22**
Maintenance and repair		**12.80**
Labor		**40.00**
Fuel	**29.08**	
Lube/filters/grease/oil	**10.91**	
TOTAL	**146.83**	

If we rework the production problem from the previous section, 21 cords skidded over a nine-hour shift:

Cost/cord = 9 hours x $146.83 / 21 cords

= $62.93 / cord

Implications

Obviously, unless you have cash reserves, you cannot operate the skidder for the machine rate ($132.46) very long if out-of-pocket costs are $146.83. Many wood buyers, foresters, engineers, and accountants trained in machine rate costing, do not realize this. When negotiating contracts, point out the real costs to them. There are some "clinkers" in using cash flow analysis. First, your accountant bases machine costs on depreciation; if you charge cash flow rates and make more money, you will pay more income tax. Tough, but at least you will earn the money to pay it. Also, at the end of three and a half years when the skidder is paid off, you'll still be earning that $46.82 an hour (principal and

interest) with no payments, until the skidder wears out or you trade again. So you'll make more profit! I don't know any loggers who can't stand earning a little extra money, but chances are there will be costs that you overlooked. Bank that cash to pay the inflated price of your next skidder. In both methods, we averaged capital (depreciation or principal), interest, insurance, taxes, and maintenance and repair (M&R) over several years. In fact, M&R costs are lower in the early years and all other costs are higher. Using average costs balances high initial taxes, insurance, and depreciation expenses against M&R costs that climb as the machine ages. That's the problem with average costs. Like the man with his feet in the oven and his head in the fridge – on average he's comfortable. If you like, actually calculate your costs year by year. Just be sure you know your real costs, then there are no surprises.

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Chapter Five

Work; Measuring and Analyzing it

What is Work?

What is work? If you work an eight-hour day, do you work eight hours times 60 minutes (480 minutes)? Not likely. You may put in an eight-hour day, but it's unlikely that you work each minute. Only the time you spend producing something of value – performing a task that contributes to some goal – is work. Work is doing what has to be done; play is doing what you want to do. Some people play and expect to be paid for it. But not loggers.

Consider cutting for tree-length skidding. You can break the work into components, such as:

Preparation

a) Locate the tree to cut
b) Walk to the tree
c) Plan fall and escape route
d) Cut brush and lower branches

Felling

a) Undercut
b) Back-cut
c) Wedging (maybe)

Limbing

a) Limbing
b) Topping
c) Lopping slash (maybe)

Delays

a) Repair, refuel, sharpen saw
b) Hangups, pounding wedges, rolling with peavey, waiting for skidder to pull it down
c) Bar pinched
d) Rest
e) Visiting

Records are important; if a cutter knows how many trees he cuts in a day, he realizes when his production is down.

In a softwood thinning in eastern Maine, the percentage of time devoted to the major components was:

Preparation 20.5%

Felling 8.5%

Limbing ..... 15.2 %

Delays ..... 55.8 %

Obviously, something is wrong when more than half of the time is consumed by delays, but there were reasons for this. First, the cutter owned the skidder and supervised its service and repair, laid out and swamped trails and often helped with choking. As a result, his skidder worked about 85 percent of the time, with few delays. Since hourly skidding costs were higher than those for cutting, keeping the high-priced machine working was most important, and his delays accomplished this. Unfortunately, the skidder was about one-third loaded each time, so his supervision left much to be desired.

Skidding can also be broken down into work elements:

Trip out-travel empty from landing to stump

Bunching (repeat cycle until fully loaded)

a) Looking for/drive to tree

b) Choke

Trip in-travel loaded

Unhooking-sometimes involves sorting

Decking

Delays

a) Servicing (fuel, lube)

b) Maintenance and repair

c) Waiting for cutter

d) Swamping trails

e) Pulling down hung trees

f) Rest

g) Visiting

h) Dressing road or landing

i) Pulling trucks out of the mud

Study of the operation in Maine was done with a stopwatch over a six-day period by two men, one timing cutting and another skidding. Few loggers can afford this but there are some simple ways for any logger to improve his operation.

First, list all steps involved in each aspect of work. Since you are familiar with your operation, this is easy to do, but check yourself in the field. For each of the steps, ask the 20 questions posed in the next section to see what changes might be feasible. Some improvements are obvious; others may be deceptive.

For example, when skidding with a small tractor, we had many delays caused by dragging tree-length in a poor trail. Loads hung up on slumps and large rocks, slowing and sometimes stalling the tractor. Logs were often lost. Since we were timing the operation it was easy to check the data later to find the problem.

lt was obvious most delays occurred when loads were longer than 25 feet. So the next day we cut long stems into two pieces. Guess what –no more skidding delays! Success, we thought. But later, when we compared production rates, we found that choking the extra pieces used all of the time that was saved in delays. You can be fooled by appearances, even when using a stopwatch. It may take trial and error to check our new methods.

In another study, the grapple skidder operator decked each turn at the landing, which took about a minute. On the next job, we asked him to deck every other turn. Result? Saving just one minute on every other trip bought three more trips in a nine-hour day. That shows how a simple change might boost production and profit. Several simple changes in your current operation could be better than buying faster or more powerful equipment

With time studies, observers with stopwatches time each step of work so you can pin down delays and poor practices. This requires at least one person to time each worker: with grapple skidders, you may even need two. Also recorded are tree size, skid distance, number of stems (and sizes) per turn and other facts that help measure productivity. The cost is high, and the results fit only that particular job. This is not reasonable for the working contractor.

There are substitutes for time study which any logger can learn, and which offer good management control. One is work sampling. which we'll discuss in a section that follows, but the other is very simple: have each worker keep a daily record of (1) production,(2) hours worked, and (3) conditions or events that affected work. The table included here contains some suggestions.

These basic facts about each job will help you estimate costs per cord or MBP and understand the effects of job conditions on production and cost values such as tree size, mix, and cut intensity need not be precisely measured but can be estimated easily by an experienced hand.

Consider data recorded by the cutter. If they knows how many trees they cut each day, they realizes when their production is down. This might then be related to tree size – a major factor when cutting pulpwood with a chain saw –or site conditions. The mix of softwood and hardwood affects limbing because hardwoods have fewer but larger branches.

If you separate weekly costs of cutting and skidding, you can determine cost per cord for each. Then compare production and cost with site conditions to see how conditions affect productivity. Most loggers carry this in their head, but a written record is better when bidding on stumpage or contracts. Records impress bankers when you want to borrow money and may result in a lower interest rate. Business owners without knowledge of or control over costs are poor risks to a banker.

Keeping these records is easy if you use simple forms and buy an inexpensive counter for each man who keeps them. Filling out production forms at the end of each day may seem useless, but it is good business practice.

20 Questions You Should Ask

The simplest method of analyzing any type of work is to observe each step of the process and ask twenty questions which cause you to think about each step and its importance and order in the operation. This analysis is quick, easy, and quite revealing. The questions are the familiar what, where, when, who, and how, with variations, as follows:

What is being done?

Is it necessary?

What else could be done?

What should be done?

The objective of these four questions is to eliminate operations that might be unnecessary.

Where is it done?

Why is it done there?

Where else could it be done?

Where should it be done?

When is it done?

Why is it done then?

When could it be done?

When should it be done?

Who does it?

Why do they do it?

Who else could do it?

Who should do it?

The objective of these 12 questions is to find ways to rearrange or combine work in a more efficient order.

How is it done?

Why is it done that way?

How else could it be done?

How should it be done?

The objective of these four questions is to find ways to simplify work.

Every logging contractor or supervisor should frequently walk around the operation and critically ask these 20 questions about every activity. For example, consider limbing, one of the more costly and dangerous aspects of manual culling:

Q. What is being done?

A. Limbs are being removed from the tree stem.

Q. Is it necessary?

A. Yes, the mill will not accept logs with limbs attached.

Q. Where is it done?

A. In the woods, where the tree is felled.

Q. Why is it done there?

A. Because that's where it has always been done.

Q. Where else could it be done?

A. This is where your imagination can run wild, almost. You could limb in bunches, in the trail, or even at the landing. Each has problems, but any are possible – the choice depends on whether the benefits outweigh the disadvantages. This might even require some experimentation.

Q. Where should it be done?

A. The answer to this depends on your particular situation. In deep snow, it is often much easier to pull the trees into the trail before limbing.

Q. When is it done?

A. Immediately after felling.

Q. Why is it done then?

A. Because we have always done it then.

The next two "when" questions are really the same as the "where" questions above, so let's go to who.

Q. Who does it?

A. The chopper. Who else?

Q. Who else could do it?

A. The skidder operator? Maybe. Someone at the landing? Again, maybe. You might even consider adding someone in the woods or at the landing if this would improve your productivity.

Q. Who should do it?

A. The answer to this would take some hard thinking, possibly even trying some alternatives.

The answers to where, when, and who may help you combine or rearrange the work to improve efficiency. But there are still four more questions:

Q. How is it done?

A. After the tree is felled, the chopper walks up the stem and cuts off the limbs with the saw, then he lops the tree at the merchantable top diameter.

Q. Why is it done that way?

A. Don't you know anything about logging? How else could it be done?

Q. How else could it be done?

A. Good question! There are several choices. First, if you are cutting softwoods, a mechanical delimber might be the solution, usually at the landing, but possibly in the trail, or even at the stump. With chain saw limbing, there are other choices, for example:

1. Fell several nearby trees together, then limb them as a group. One cutter in eastern Maine did this regularly. In groups of 2-4 trees, his limbing time per tree was cut almost in half. This technique might be worth a try, especially in heavy cuts where the trees are closer together.

2. Instead of limbing the tree, just lop it. Many of the limbs will break off in skidding, making limbing at the landing

faster and cheaper. This takes us back to who will do the work at the landing.

3. A modification of number two –remove only the green limbs. The dead ones will break off in skidding.

4. Top the tree at the first live limb, leaving the upper stem with green limbs in the woods. This may work when culling small trees for pulpwood but wastes much wood when culling larger diameters.

5. Just limb the branches on the top and sides, leaving the bottom ones to break off in skidding. The unbroken limbs and stubs need to be removed at the landing.

And now for the last question:

Q. How should it be done?

A. Making a choice from the five options is often simple, but more often than not, some trial and error is necessary. A good idea may not work the first time – you may have to try again. Only you can answer this question.

This is just one example of how to apply the 20 questions. Ask these questions about any work activity – even filing in the office. It is a very basic approach to reducing and simplifying work, and hopefully improving production and profits.

Unfortunately, the answers do not indicate how much change to expect – they are simply ideas about where to look. The effects on time, cost, and production will require more study, but improvements can often be made with this simple approach.

Work Sampling

Previous sections have touched on ways to analyze operating costs. The most common method, discussed earlier and used unconsciously by many loggers, is called gross time study and uses weekly records of time worked, money spent, and units produced. At the end of the week, average production (units per hour) and costs (dollars per unit) are easily computed. With a little refinement and some extra records (see "Know Your Costs" and "What is Work"), a contractor can get a handle on productivity and costs and the effects of such factors as timber size, topography, and weather.

Another method – referred to often and used rarely – is time and motion study, sometimes called "detailed time study." This is stopwatch timing to precisely nail down work and costs. It is too expensive for general use but is useful for research and analysis of new techniques or equipment. A third method – work sampling – is simple, well suited to logging, and can be built into normal supervision with little extra work. It is widely used in factories but rarely in the woods. A good analysis of its potential is described by Miyata et al. (1981).

Work sampling involves recording instantaneous observations of work activities at random intervals. An instantaneous observation is like a snapshot of what work is taking place at a particular instant. For example, at a predetermined time, you look at skidding – what the skidder is doing at that moment – and record it on a tally sheet. After making say 100 observations of skidding, you may find that 26 times the machine was delayed for some reason – refueling, driver resting, repairs, blading the trail, etc. – and the rest of the time it was working. So 26 times out of 100, or 26 percent of the time, the machine was delayed. Since you want to minimize delays, look at their causes to find ways to cut the amount of delay time.

Suppose the driver was resting 19 out of the 26 times? If you pay by the hour, you better find a new driver, or change to piece rate. If you pay on a piece-rate, he may have a physical problem that affects his work (or you may be paying too much). Whatever– as soon as you identify the problem, you can begin solving it. Also, look at working time in detail – what is taking place? Of the 74 times you observed the skidder working, suppose it was bunching 50 times – 68 percent of the time? That is not unreasonable for short skids, smaller-than-normal timber, or scattered trees, but normally 68 percent is on the high side. But if you identify the cause and cut bunching time, you can improve productivity because a skidder earns most when it is hauling wood.

So much for the process – now you can see the ways in which you can improve your operation. The rub begins with two factors – breaking work down into steps and determining when random observations will be made. An earlier section ("What is Work?") illustrated how the work of chain saw felling and cable skidding could be divided into steps. For example, skidding consists of six major activities:

Trip out - travel empty from landing, in trail

Bunching - driving to and choking wood

Trip in - travel loaded to landing

Unhooking - unhooking wood at the landing (possibly sorting)

Decking - pushing wood into proper piles

Delays - fueling, maintenance, rest, etc. (non-working)

Each of these can be further divided. For example, bunching could be a series of work cycles such as:

Drive from trail to first stem

Dismount tractor
Pull cable
Choke stem
Wait for tractor
Mount tractor
Winch load
Drive to next stem - begins the next cycle

By the time you go through the skidding work sequence, you'll have quite a list of activities. Making the list will raise questions in your mind about how to simplify work, but putting numbers on the activities will show you where time is wasted.

How to pick random times for observations? Some calculators have random number generators, or you can get a statistics book with a table of random numbers, or – use a deck of playing cards. Shuffle the cards well and turn them over, beginning with the top of the deck. If work begins at 7:00 a.m., and the first card you draw is a 6, the first observation is at 7:06. If the next card is a 9, add 9 to 7:06 and you come up with the next observation at 7:15, and so on.

There are two ways to use work sampling. Assign an employee (better yourself) one or more days a week, or one or two hours a day. Pick the days or hours by drawing cards. Workers develop habits and patterns. Work is faster in the morning than in the afternoon – mid-morning coffee breaks become a habit – the chopper may stop to service his saw every time the skidder is in the area, and so on. Vary observation times so as to not observe people at the same time each day. If they expect you, they may work faster, producing unrealistic data.

A manager who spends an hour a day randomly observing an operation will soon develop a good body of data for each worker and each machine. You'll know normal performance, and when something goes wrong, you'll spot it sooner.

Every supervisor should spend part of the day checking an operation to become familiar with how it is running and why. This is not snooping. Good employees are proud of their work and want you to see how well they are doing. You learn about them, their capabilities, their problems, job conditions, and equipment performance. This is all part of being a manager.

And integrating supervision and work sampling makes you more efficient and more observant.

To set up a tally system, divide work into its steps, listed down the left-hand side of a sheet of paper (right). As you make observations, simply enter a check (or dot tally) after the work activity. At the end of the sampling period, add the

number of observations in each step and the total number of observations. The percentage of work in any one category is its number of observations divided by the total (multiplied by 100 percent).

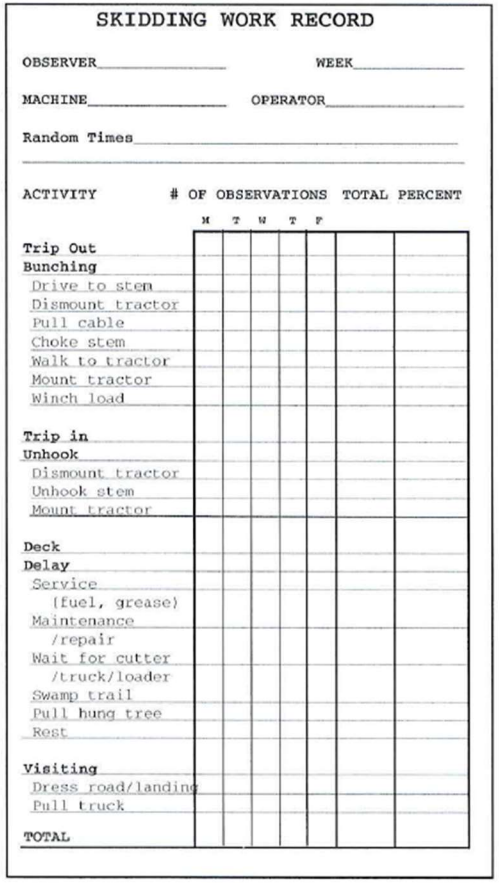
If you are working in an area where you can observe more than one activity, keep a tally sheet for each. If one depends on the other, use random timing for both, but if not, use random times for one and arbitrarily check the other at, say two minutes later.

One set of observations is of little use, but several hundred observations are a reasonable data set for a machine or operator.

Then using the previous section "Twenty Questions," take a good look at your operation. You'll be surprised at how much you can learn about your logging show by looking at it analytically.

Even if you do not analyze each work step learning extent of the delay time and its causes is extremely helpful.

Work sampling is also a good way to break in new employees. It will give experienced hands a chance to see how everything fits together and they'll learn more about their importance as part of a team. Their insights and ideas will surprise you (maybe not the way you expected). Try hiring bright high school or college students during school vacations. You'll help them and yourself.



SKIDDING WORK RECORD

OBSERVER_____ WEEK_____

MACHINE_____ OPERATOR_____

Random Times_____

ACTIVITY	# OF OBSERVATIONS M	T	W	T	F	TOTAL	PERCENT
Trip Out							
Bunching							
Drive to stem							
Dismount tractor							
Pull cable							
Choke stem							
Walk to tractor							
Mount tractor							
Winch load							
Trip in							
Unhook							
Dismount tractor							
Unhook stem							
Mount tractor							
Deck							
Delay							
Service (fuel, grease)							
Maintenance /repair							
Wait for cutter /truck/loader							
Swamp trail							
Pull hung tree							
Rest							
Visiting							
Dress road/landing							
Pull truck							
TOTAL							

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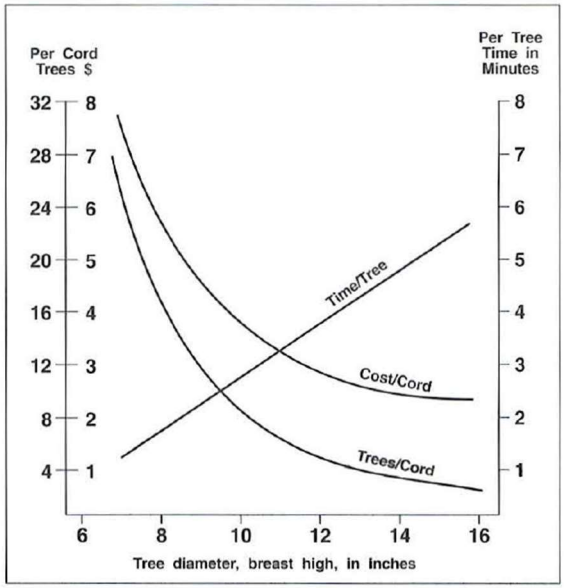
Tree Size Affects Logging Costs

In a study conducted in northern hardwoods in New York State (Kolen and Flatau 1979), two skidders of equal capacity were operated under similar conditions. About the only difference between the physical conditions on the jobs was tree/log size: the logs on one operation were about 40 percent smaller than the logs on the other.

Though the number of logs per turn was about the same, the skidder in the smaller timber produced much less volume per day. Part of this problem was due to cutting, because the chopper had to cut more trees per thousand board feet and the skidder operator apparently adjusted his speed and load size to keep up with his partner's production. He ran more turns, at a faster speed, but his daily production was much lower than what was produced with the other skidder.



In eastern Maine (Hoffman 1978), a 70 horsepower skidder was only producing one-third to one-half of normal volume. The problem? The operator, who was accustomed to skidding trees of 10-16 inches on the bull end, was in smaller timber running 8-12 inches in diameter. Since the smaller trees were also shorter, his productivity was way down. He was still running the same number of chokers, and they were filled every trip, but the load volume was not the same.

Underloading is a common problem, probably more so with cable skidders than grapples. Feller-bunchers can usually pile full bunches, regardless of tree size, but bunching is much more difficult with chainsaw felling. Heavy cables and chokers are tough to drag, especially in partial cuts where uncut trees get in the way. Often you can only reach six or seven trees with one cable: getting more means moving the skidder, which takes more time.

If you often work in small timber with a cable skidder, consider buying a double-drum winch and smaller cable and chokers. Two drums permit you to pull cable in two different directions from one setting, which can double payloads. Those who have tried this setup find it easier to consistently choke full loads. Lighter cable and chokers make work physically easier, and two cables double the working area. The major drawback is the extra cost of a two-drum winch – but consider the cost on an hourly basis and compare it with the probable increase in production per turn.

The aspect of logging most affected by tree size is cutting, because each tree is handled individually. The graph to the left was prepared from cutting data collected in eastern Maine. Tree sizes ranged from six to 16 inches. First, look at the sloping straight line which shows the relation between tree diameter (bottom axis) and time to cut, limb and lop (right axis). Just to illustrate the effect of tree size on cost and productivity, let's compare 6-inch and 12-inch trees.

Using the time/tree line on the graph, note that the time (right axis) to cut a six-inch tree is about 1.5 minutes, while a 12-inch tree takes nearly four minutes. But, if you look at the curve representing the number of trees per cord, you'll find that there are about 25 six-inch trees per cord, compared to four 12-inch trees. Thus the time needed to cull a cord of six-inch trees is 25 x 1.5 or 37.5 minutes, versus four 12-inch trees x 4 minutes, or 16 minutes/cord.

At that time (1978), wage and saw rates resulted in a cost of about $2.80 per cord for the larger trees versus $7.50 for the small ones.

The difference between six-inch and 12-inch trees is clear, but consider the difference between 10- and 12-inch trees. Ten-inch trees cost about 13 percent more than 12-inchers. This is not important until you consider the added cost over your weekly production. If the mean diameter of the trees you are cutting declines from 12 to 10 inches, and your weekly production is 100 cords, your cutting costs will be significantly higher for the week, and your chopper will work harder. To some extent, smaller average tree size and volume may also increase skidding and loading costs per cord. The effects of tree size on costs can sneak up on you, and as diameter declines further, the "sneak" gets faster.

The aspect of logging most affected by tree size is cutting, because each tree is handled individually.

The real effect of tree size on cutting is not diameter, but cross-section area of the stump (the actual area which the saw cuts) and height of the merchantable bole (which affects the number of limbs to remove). These factors are both closely related to what is termed "basal area," the cross section area of the tree at breast height (4.5 feet above the ground). The best estimate of tree size is the mean stand diameter, which is the diameter of the tree of mean (average) basal area. In logging, the important value is the mean diameter of the trees which are to be cut

When you buy timber, cruise it to determine the number of trees by species and diameter class. This will enable you to estimate mean tree size so you can better balance your cutting and skidding production. It will also help you plan your marketing. Then, make sure you have enough chokers to insure full loads. Also, make a simple map of the area showing timber concentrations so that you can locate your roads and trails for best efficiency.

At this point (1991), research in this country has not provided enough information for loggers to readily estimate the effects of tree size on productivity. In Norway, government studies have computed average times to fall, limb, and buck trees of different sizes, by species. With this information, if you knew how many trees you had to cut by size and species, you could calculate your cutting costs. Similar studies have been done for skidding. But, there is little data of this type available in North America. Our only recourse is to keep good records of costs and average tree size as a rough indicator of how costs might vary with size.

With feller bunchers, tree size has little effect on the time to cut and bunch a tree, until you begin to cut sizes, which tax the machine's hydraulic system. Thus cycle times per tree for six and 12-inch trees are about the same. But, if you cut 150 trees per hour, the effects of tree size quickly show up. The six-inch trees add up to 6 cords per hour, but the 12-inchers make up 37.5 cords – quite a difference. Thus mechanical felling and bunching productivity are greatly affected by tree size.

Interestingly enough, while tree size and value gradually decline, machine size and cost increase rapidly. Balancing these two factors grows increasingly difficult. When cutting small trees, a small machine can cut just as rapidly, and maybe even more so in thinning, than a large one. A few manufacturers have realized this and now offer smaller machines for thinning and cutting biomass. However, while small machines may be better for cutting, large payloads are generally more economical when skidding.

Unfortunately, while we know that tree size does affect productivity, there is no practical way to predict how much. Again, the best solution for now is to keep good records of production and mean tree size (of cut trees) to see how your operations are affected.

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Small – Is it Beautiful?

Many landowners and foresters –including me – have been intrigued with the idea of using smaller logging equipment to reduce damage when making partial cuts. Students in my timber harvesting class at the University of Maine had *Small is Beautiful*, by E. F. Schumacher as assigned reading – not because small is best, but because many students feel that bigger is better, which ain't necessarily so. At least by reading the book, they got another point of view.

While small machines have a place, they are generally not economical for timber harvesting. I learned this the hard way when I was logging and was forced to trade crawlers twice in the first year, nearly doubling my horsepower. Nowadays as trees get smaller and costs climb, there is more pressure on loggers to buy larger machines to pull bigger payloads. But despite economies of scale, you can reach the point where a machine's cost is not justified by the work that it does, like using a dump truck to take your trash can to the landfill.

Based on my research and experience, small equipment does not usually pay. For example, a few years ago I timed a 21-horsepower farm tractor and a 70-horsepower rubber-tired skidder, calculated the value of skidding, and subtracted the cost of owning and operating each machine, without labor. What was left had to pay labor, taxes, insurance, and profit. The small tractor's hourly revenue production was about 62 percent less than the skidder. Obviously, if you had to make a living skidding wood, you would not choose the little tractor.

On the other hand, a landowner who has a small tractor for snow removal, mowing, and gardening is better off using it to get his firewood than investing in a larger, specialized machine with limited use for him.

There is a fine line between choosing the right machine and being stuck with payments you can't afford to make.

Interest in small machinery often centers on low purchase price and low hourly cost. But, in the case of the small tractor and skidder, the higher cost of the skidder was offset by its higher productivity. A study in Virginia (Stuart 1988) compared thinning with 90 and 130-horsepower skidders under similar conditions. Both crews had been trained by the same operator. Though the price of the small skidder was much less than the larger one, its hourly cost was only a

few dollars lower. But its hourly production was much less. The result: greater production and profit with the larger machine.

Both logging sites were also examined to see how equipment size affected damage to the residual stand. It may surprise some, but stand damage was the same on both lots. Many studies have observed that the major factor in stand damage is not equipment size, but the planning and care used by the logger. A good operator with a large skidder often causes less damage than an average operator with a small one. In fact, a smaller machine may cause more soil compaction because it makes many more trips to remove a given amount of wood.

When I was logging with a crawler, many landowners wanted wood bunched by a horse; some even insisted on having the blades removed from tractors used for skidding in the woods. When tree-length logging began, many timber sale contracts limited the length of loads. After wheeled skidders came in some contracts required pre-bunching with crawlers. These practices reflected landowner concerns for the condition of stands after partial cuts. Yet every forester could name half a dozen operators who could do a fine logging job without these restrictions. This tells me that the operator, not the machine or method makes the difference.

This concern of landowners has been a major factor behind the interest in small equipment and has also led to interest in using small machines to pre-bunch wood for large ones. Small tractors, farm tractors with winches, portable winches, small crawlers, even horses have been tried for pre-bunching. In most cases, the added cost of handling wood one more time exceeds the cost of using the larger machine for this job. One exception was the use of horses to bunch wood for helicopters (Dykstra et al 1978) in the West.

In Maine, Seymour and Gadzik (1985) found that pre-bunching was not only marginal at best but that well-planned skidding by a skilled operator caused no more damage. In this study, the skidder hauled up to 50 pre-bunched trees in a single turn! The front wheels even left the ground. Despite much higher – maybe too high – payloads the extra handling step involved in pre-bunching was too costly. Large payloads are not necessarily better if overloading causes your skidder to become stuck, or forces you to drop the hitch and winch it through tough going.

Before you buy any machine, carefully analyze its probable productivity under your working conditions. There is a fine line between choosing the right machine and being stuck with payments you can't comfortably make. If in doubt, persuade your dealer to let you try, or even rent, before buying. Better to rent for three to six months than get stuck with several years of payments on the wrong piece of iron.

If you mechanize felling – and many more operations face this as the skilled woods labor force declines and worker's compensation insurance costs increase – make a careful analysis of how mechanical felling will affect your skidding and trucking. You may need a larger skidder, another skidder, or have to switch to grapples. Will it work in your terrain? Will it pay? Can you balance felling and skidding by running your current skidders longer hours? Can the markets absorb higher production? Or, could you run your

feller-buncher for fewer hours a week but over a longer useful life? Consider all of the possibilities. Then choose.

Research has repeatedly shown that properly planned logging done by careful operators is the secret to higher profits for the logger and satisfied landowners. Put yourself in a competitive position which results from a good reputation. Not only is stumpage easier to find when you do, but the price is lower.

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Analyzing Costs and Methods

We have already discussed the importance of good but simple business records, the value of analyzing work methods, and more recently the importance of choosing the right size equipment. In my visits to some loggers in northern British Columbia, Canada, these three topics came together in one place.

First, a common problem in logging is that high cash flows combined with some less obvious costs, such as depreciation, often promote a false sense of security. One logger in B.C., after eight successful years in logging and milling, had just gone bankrupt. Those large weekly incomes were simply spent in the wrong places, and suddenly he was behind in cash reserves. In view of his experience, he expressed some concerns about some friends of his that I was visiting. They had been in the business for three years, were doing well and growing solidly, but this year they lost several thousand dollars out of a gross income of more than $1 million.

What happened? Fortunately, these loggers had their costs nailed down — but not until after the end of the year. Then, they could pinpoint the production of each operator and machine and had complete downtime and repair cost records for each piece of equipment. I was impressed by how complete their records were, and their ability to identify problems. Now the records are computerized so that they can check performance at any time they want without having to wait until the end of the year.

Most of the losses these loggers experienced resulted from high rental and repair costs on an inadequate feller-buncher. This problem they identified early and corrected by ditching the machine. They now contract with an owner-operator to cut for them. This was a smart move, because the cost of a saw-equipped machine at that time was $350,000 (U.S.), which means high interest payments, another set of spare parts to maintain, and another operator to train and nurture.

Other interesting things showed up. Hourly payroll cost for some operations was higher on a unit (cord) basis than planned. Solution? Pay by the unit, not by the hour, and lock those costs in. Loader productivity was interesting, too. Two loaders of equal size had quite different production, and the operator who produced the most was on vacation for a month. But the big whammy was skidder productivity. Two 130 HP grapple skidders produced 44 percent of the wood while one 175 HP unit produced the other 56 percent. That backs up the research studies about equipment size discussed in the previous section. One solution — trade the two smaller skidders for a new, large one. But their machines were too new — the dealer would not trade well and the bank would not finance the trade.

Still, at first glance, trading seemed to be the wise choice, especially in view of high maintenance costs of the small skidders and the fact that one was going off warranty and the other to partial warranty. Breakdowns were common, and some indicated inadequate design or abuse, or overloading. But there may be a simpler alternative.

On this operation, full-tree skidding is practiced. In an early study of skidding technology, two Canadian researchers found that full-tree skidding required 55 percent more power than tree-length (Calvert and Garlicki 1969). In other words, the tree-length log volume that can be moved with 130 HP would require about 200 horses in full-tree form. Thus about 65 percent of the power is required to move the stem and 35 percent to move the top. Since the top is only about 25 percent of the weight of the tree and requires 35 percent of the power, skidding tops is expensive. Contrary to what many people would have you think, tops do not ride free. Unless you can market tops as chips, you need to think twice about skidding them.

This operation was marketing only the sawlog portion of the tree. As with many operations, skidding full trees simply permits mechanized delimbing at the landing or roadside. In this case, delimbing is done by a skidder with a modified blade. If the tops could be left in the woods, productivity of the small skidders could be boosted about 35 percent. Also, the additional load stresses and hangups caused by longer and wider full-tree skidding would be eliminated, which might reduce downtime and maintenance costs. On the other hand, delimbing and lopping in the woods might be more expensive. This is a good time to resort to the twenty questions posed earlier.

How can you delimb in the woods behind a feller-buncher? Could the skidder with the delimbing blade work on bunches in the woods? If so, how could you top those trees? Do you need to top them? Could a person with a chain saw delimb and top safely, satisfactorily, and cheaply enough in the woods? Could a combination of skidder delimbing and chain saw topping be used? How many people would be needed? Do you really need to limb; would lopping suffice? Could you modify the skidder to mechanically remove the tops? The only way to find out is to try all methods and see which one works. And after you answer all of those questions, you still need to know whether it is cheaper to skid tops out and delimb at the landing or delimb/top in the woods and skid tree lengths.

Contrary to what many people would have you think, tops do not ride for free.

On a chainsaw/skidder operation in northern Maine, I observed a cutter who felled several trees together and then limbed and lopped as many as 7-8 in a bunch. Based on this, I suspect that a sawyer with a light saw and long bar could safely remove the easy-to-reach limbs and top the bunches left by a feller-buncher. On even-aged softwood clearcuts, most trees are the same height, and topping is fairly straightforward. A sawyer should only remove those branches that are easiest (safest) to reach, and maybe he doesn't need to limb at all. As limbing is one of the most dangerous jobs performed with a chainsaw, careful planning is needed to minimize both hazards and physical work. And a person on the ground must be safely separated from felling and skidding.

Getting back to the British Columbia loggers, what really intrigued me was their ability to pinpoint costs and production by man and by machine. In this way, they could compare the productivity of each person and machine, relate it to ground and timber conditions, and spot problems. They could also identify machine problems through production and maintenance records. Now that the records are computerized, they will have access to this information throughout the year, not just for tax and year-end accounting.

Records can never take the place of carefully looking over your operation and visualizing ways to improve it, but they can help you put values on your options and make better choices.

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Chapter Six

Roads and Trails

Roads and Trails

The difference between roads and trails is often unclear. I have heard the terms "skid road" and "truck trail." In both cases, the difference seems to be relative – a skid road is a high-grade main haul route for a skidder, whereas a truck trail is a low-grade truck way. An easier separation is to reserve the terms "road" for highway-type vehicles and "trail" for off-highway vehicles.

So how do we differentiate between classes of roads? Terms such as Class 1, Class 2, etc., are fine, if you know the standards for each class. A more general method might be to describe the surface – such as paved, gravel, unsurfaced – or season of use, such as winter, summer, or all-weather. We could also use "public" as a way of describing public highways, and call woods roads "main" or "secondary" roads. An easy way to classify trails is with terms such as "main" or "primary," "secondary" or "tertiary." For trails used only once or twice, the term "corridor" is appropriate.

Probably half of the total cost of logging in most areas, and certainly more in some regions, is moving wood from the stump to a public road. There are many different ways to do it, but most loggers skid to a landing near a public road, then haul the wood to the mill by truck. Some use forwarders to get their timber to the public road, then haul by truck. Others use cable yarding systems, and some use a combination of the above.

The method you choose determines whether you skid or forward in the woods, and the horsepower, frame, tires, and the number of driving axles on your truck or truck-trailer. With a forwarder, you may not need a loader at the landing, and the type of material you produce – such as tree-length or bucked lengths – determines the truck/trailer combination you will use. If you never drive your truck off public roads and roadside landings, your truck horsepower, frame, and tire requirements will be more modest.

Spending the money up-front to build a good woods road can cut skidding time, saving money over the life of the job.

While it is essential to consider economic aspects of things like roads and trails, their spacing, and whether to haul or skid your wood to the main landing, you also have to look at the day-to-day problems of transporting wood.

In logging, the shortest distance between two points is rarely a straight line, but the main consideration is safety and time, not distance. The shortest distance in rough terrain is usually the steepest route, but the fastest route with the least delays will be longer, with gentler grades. The quickest route may actually be the longest distance.

The two aspects of truck roads that I want to concentrate on here are 1) grade, and 2) surface, and the single aspect of skid trails is grade. Grade is the change in elevation in a given distance, usually the rise in feet per 100 lineal feet, expressed in percent. For example, if a road climbs 10 feet in 100 lineal feet, the grade is 10/100 or 10 percent. Ten percent is about the maximum grade for truck roads, though it is often necessary to use steeper grades for short distances.

Steep grades are fine in dry weather, but rain, snow, and ice can quickly create problems. Steep grades might mean having to pull trucks with a skidder. When that happens, any money saved by building short, steep roads is quickly spent by the added cost of pulling trucks, not to mention lower wood output because both truck and skidder are delayed. And how about the extra wear and tear on the truck? Lower grades may also mean not having to "chain up" in winter.

Short, steep climbs may sometimes be needed to avoid ledges or other obstacles, but be sure to precede them with gentle stretches so trucks can gain enough momentum to climb the grade (and brake when going down). If you can't avoid a steep grade, a layer of gravel may provide wet-weather traction. Gravel is also helpful on curves, as is sloping the road surface downward, toward the ditch.

Many mud problems result from roads built on wet soils. A common method for handling wet sites is to log in the winter when the road is stabilized by freezing. In cold climates, streams may freeze, eliminating the need for culverts and bridges. It is common, however, to find some wet soils on any logging site most of the year, and they can create serious mud problems.

If roads are built a year in advance, they will go through one freeze/thaw cycle before final grading, and most mud problems will be eliminated. Building roads in advance is a luxury most loggers cannot regularly afford, so most learn to live with mud.

When you must cross wet soils, try geotextiles. Geotextiles are fabrics designed to separate fill or gravel from unstable soil. They keep road fill from mixing with the wet soil and add support for the fill layer. If you dump gravel on wet soil, it soon mixes in and dissipates, forming mud; geotextiles prevent mixing and add mechanical support. An added benefit is that fabrics usually provide enough mechanical support to cut gravel needs by about half, and the savings in gravel alone may be more than the cost of buying and installing the fabric. "Cheap gravel" is how some loggers describe geotextile material.

The texture of geotextile fabric ranges from that of plastic grain bags to felt blankets, depending upon the strength, type of support, and water permeability required to do the job. Fabrics come in rolls up to 12 feet wide or more and several hundred feet long. For culverts and bridge approaches, I have used salvaged synthetic carpet. Though carpet pieces are rarely more than 20 feet long, they are fine for small jobs. You can make up for short lengths with plenty of overlap. If your local carpet contractor pays a disposal fee at the dump, he will gladly supply you with old scrap carpet. You can avoid rot by using synthetic carpet.

To measure road grade, you will need an Abney level or clinometer. Both are available from most forestry equipment suppliers for about $75 or less. Both are easy to operate and are also useful for measuring the height of standing trees. When laying out roads, check the grade with the instrument and try to keep climbs of more than ten percent to a minimum. A few trips between the landing and roadside will help you find the best route and grade. Shoe leather is still cheaper than dynamite and gravel.

For details on road construction techniques, get a copy of your state's best management practices (BMP) for water quality guide. The US Forest Service (www.fs.usda.gov) has several publications available on road building.

The Natural Resource Conservation Service (NRCS) office in your area may offer technical assistance as well (www.nrcs.usda.gov) .

Skid It or Truck It?

Loggers often face the problem of access to timber and the question, "Do I skid it or build an access road?" I faced this question many times and was always too busy to sit down to figure it out. Actually, the solution is fairly simple, if you know your costs.

The cost of trucking logs over a short stretch of woods road is relatively small, and the main factors to consider are road building costs versus skidding costs. In other words, which is cheaper, to build a road, or skid? This question arises in two ways. "Should I build an access road?"– a fairly simple question to answer – and, on large tracts, "How far apart should I space roads?" We'll tackle the first now, and road spacing in the next section.

For this discussion, access roads are for trucking from a landing to an existing road which will carry all timber from the operation. Within the tract, we may also build secondary roads to reduce the skidding distance for some of the timber.

To decide whether to truck or skid, we must know the cost per mile to construct truck roads and the variable cost of skidding. Variable cost is the round-trip travel cost of actually moving the wood. Choking, bunching, unhooking and decking costs are the same for every turn, but travel cost varies with distance. Think of travel cost as the cost per hundred feet of skidding distance (200 feet round trip).

If you know your costs, fine. If not, either guesstimate them or make a simple study. With cable skidding, travel is roughly half of total skidding cost because cable skidders spend about half of their time dragging logs in or running out empty. Grapple skidders may spend two-thirds of the time in travel.

To see how this works, assume we are using a cable skidder on the operation in the diagram on the next page. We have a choice of two landing locations, point A, an old gravel pit next to the highway, or B, a level spot within the timber sale area. It is 700 feet from B to A. Also, assume that our skidding costs for the past month averaged $22.00 per cord and skidding distance averaged 600 feet.

If skidding costs have been $22.00 per cord, then variable cost – travel only – would be half of that, or $11.00. Also, if average skidding distance was 600 feet, the cost per hundred feet would be $11/6 = $1.83 per cord per hundred feet. If we skid 700 feet to the highway, it will cost 7 x $1.83 = $12.81 per cord just to skid from B to A.

If there are 2000 cords on the lot, it will cost $25,620 to skid all wood to the roadside landing. In most cases, you could build the road to point B for $10,000 or less, which is $15,620 cheaper than skidding. Potential savings are $15,620. In this case, it is obvious – build the road. Since the road has long-term benefits to the landowner, he or she may be persuaded to contribute to its cost, or to build to a higher standard (culverts, more gravel), and your potential profit is even higher.

For a better estimate of variable cost, measure travel time and distance of your skidder for eight to ten turns (round trips) and calculate average travel time and distance. If you

know 1) average travel time, 2) average distance, 3) hourly cost of the skidder, and 4) average volume per turn, it is easy to calculate the variable cost of skidding:

Skidding cost/100 feet =

Travel time turn (mins) x skidder cost/hr/60 mins
distance in hundreds of feet

Skidding cost/cord/100 feet = skidding cost/100 feet
volume/turn in cords

For example, say you timed travel for ten turns and it averaged 8 minutes per trip, over an average distance of 500 feet. Assume a skidder cost (M) of $127.00/hour.

Skidding cost/100 feet =

8 minutes x $127.00/hr/60 mins/hr

5

= 8 minutes x $2.11/minute

5

= $16.88/100 feet

If your average turn size is 2 cords, cost/cord / 100 feet is $16.88/2 or $8.44 per cord per hundred feet.

To express this in a formula:

C=(T/D) (M/60) / V

where:

C = variable cost of skidding

T =average travel time/turn

D = average skid distance in hundreds of feet

M = hourly owning and operating cost of the skidder

V = average volume/turn

Hourly owning and operating cost (M) can be determined in several ways. You can calculate machine rate or cash flow costs using the methods described in earlier sections. Or, simply calculate average hourly costs of monthly payments plus labor, repairs, fuel, and lube. V, the volume in units, can be expressed in whatever units you are using – cords, board feet, tons.

Substituting the values we have used in the formula:

C=(8 min/5 hundred ft) ($127.00/hr/60 mins/hr) / (2 cords) = $8.44

Since all wood must be skidded from B to A, a distance of 700 feet, skidding cost is 7 X $8.44 = $59.08 per cord. If there are 1000 cords to skid, total variable cost of skidding is $59,080. If the old woods road from A to B can be rebuilt for less, go for it– you can save a substantial amount. But suppose there are only 250 cords of wood to cut. Total variable skidding cost would be 250 X $59.08, or $14,770 and may be less than the cost of building the road. In this case, see if the landowner will pay part of the cost of the

road, as it will improve his access for the future and raise the value of his or her property.

Suppose the landowner will not contribute to the road? In this case, the difference between skidding and road will be minimal. Maybe it isn't worth the hassle of comparing costs, but suppose it was $5,000?

The costs of road building and skidding can be determined using several formulae:

Road cost/cord = RDNt

where:

R = road cost per hundred feet (using cost per mile or a contract price in this case $10.00 for 700 feet)

D = length of new road

Vt = total volume of wood to be trucked

Skid cost/cord = C(Dab - D)

where:

C = variable cost of skidding

Dab = distance between possible landing sites

D = length of new road

If skidding costs more than road building, then we should build more road and vice versa. In other words, when skidding cost per cord equals roading cost per cord, we are at the break-even point–the optimum road distance. To determine this, we set the two formulae as equalities and solve for D, as follows:

RdNt = C(Dab - D)

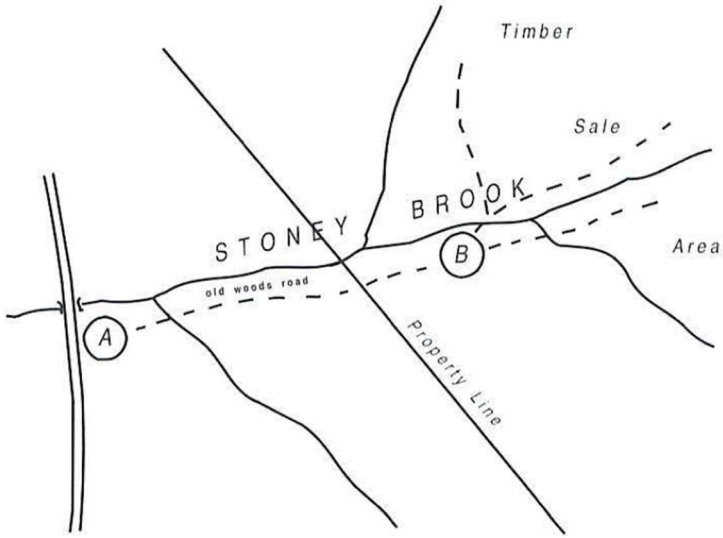
Using the values from the previous problem:

($10,000/7) D/250 = $8.44 (7-D)

5.71 D = 8.44 (7 – D)

D = 59.08 / 14.153

D=4.17



So, we should build 417 feet of road and skid 283 feet (700-D).

One of the more common examples of this same problem is in deciding whether to construct a second landing, further into the timber. This can be done in the same way. Suppose both A and B are within the sale area. Many sale contracts require you to start at the back and work toward the landing. There is a big push to get the landing established and get some wood rolling — no time to build that extra road and second landing. You don't really notice the problem because as the skidding distance gets shorter, activity at the landing speeds up, and all appears to be going well.

But, suppose you start at the easy timber and work back? This really shows up with a chipper. Everything is humming at the start, but gradually the wood supply at the chipper slows up. Pretty soon, the chipper operator is waiting for wood. By the time you reach the back of the tract, the chipper may idle more than it runs. Adding a skidder may solve the wood problem at the chipper, but it ignores the benefits of a shorter skid.

Fine — we'll run one skidder close in and the other at the back, that way wood deliveries to the landing will average out OK. This may be true, but it still ignores the fact that you might cut overall costs by building an extra eighth of a mile of truck road. This is especially true in mountainous terrain. Not only does the extra landing shorten the skid for all wood behind it, but it may halve—depending on terrain—the average skid for wood to the first landing (by bringing part of that wood to the second, closer landing).

Each job is different. Take the time to consider your access roads carefully — it may save you money in the long run. In the next section, we'll look at the problem of spacing roads within a logging area.

Road Spacing

In the previous section, we considered the basic problem of whether or not to build roads into a timber sale area. This is a common problem when operating lots of 500 acres or less in hilly or mountainous terrain. Now we can look at the problem of spacing roads within an operating area, a more common problem on large ownerships and relatively level terrain.

The spacing of roads can be affected by slope topography timber volume and landing location. The simplest problem skidding to roadside in level terrain will illustrate the method. As in the previous article, we will compare skidding costs with the expense of building roads to reduce skidding.

The figure on the facing page represents two parallel roads in level terrain. If we move these roads closer together skidding distance and cost are reduced but we will soon need additional roads. Again, we will consider the variable skidding cost –the cost per cord to skid 100 feet –as the cost of moving wood. Last time we considered road building costs per 100 feet, but this time we will use cost per mile, a more common value in road construction circles.

If we consider the distance between the two roads in Figure 1 as S, maximum skidding distance is half of that, or S / 2. Also, average skidding distance is half of that or S/4. Skidding cost per cord per hundred feet – the variable skidding cost – can be estimated in the same manner as described in the last section. If you don't know costs, measure travel time and distance and load size for 10 turns and calculate average values. You also need to know the hourly operating costs of your skidder. Then:

$$C = (T/D)(M/60) / V$$

where:

C= variable cost of skidding

T= average travel time/turn

D= average skid distance in hundreds of feet

M= hourly owning and operating cost

V= average volume/turn

Owning and operating cost can be machine rate or cash flow cost whichever you use. Or add average hourly costs of monthly payments, labor repairs, fuel lube. If you have a good handle on skidding costs simply divide half of your skidding cost/cord (65 percent if you use a grapple skidder) and divide by average skidding distance (in hundreds of feet).

Skidding cost per cord is: CS/4

where:

C= variable cost of skidding (determined above)

S= road spacing in hundreds of feet

With parallel roads, for each 100 feet of spacing each road serves 50 feet on both sides or 100 feet. Thus each mile of road (5280 feet) serves 5280 x 100 per unit of spacing. Since an acre contains 43,560 square feet a mile of road serves:

528000/43560 = 12.1 acres.

If a contractor can give us the cost per mile to build roads we can then calculate the road cost per acre, and if we know volume per acre, we can then calculate the cost per unit of volume. The formula is:

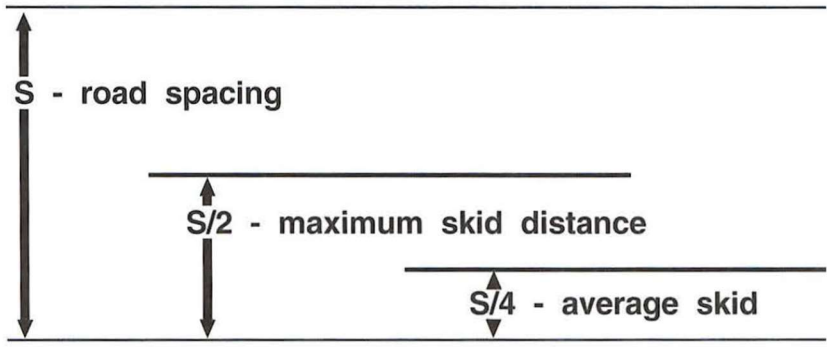
Road cost/cord = R/12.1

where:

R = road cost/mile

V = volume/acre (cords board feet tons)

S = road spacing in hundreds of feet



Road/skidding costs are optimal when they are equal. So we set skidding and road building costs as equalities and solve for optimal spacing (S):

$$CS/4 = \frac{R/12.1}{VS}$$

By reducing both sides of the equation we obtain:

$$S^2 = 0.33R/VC$$

$$S = (0.33RNC)^{0.5}$$

You will need a pocket calculator with a square root function in order to solve the problem, unless you remember how to do square roots the old-fashioned way and I don't. Trial and error also works – pick a number near the square root and try until you hit it. As an example of how this works, suppose road costs are $20,000 per mile, volume per acre is 35 cords, and variable skidding cost is $8.44 per cord per hundred feet. Then:

$$\$8.44/4 = \frac{\$20,000/12.1}{35S}$$

$$2.11 = 20,000/(12.1 \times 35S)$$

$$2.11 \times 423.5S = 20,000$$

$$S = 22.382$$

Or, road spacing should be 2,238 feet.

This is an example of the simplest type of road spacing problem, skidding to the roadside in level terrain. If you skid to landings, the problem becomes more complex. If you are skidding on a sidehill distance and cost on the uphill side will be different than on the downhill. If the road slopes between landings, skidding distances between landings will change.

Unfortunately, most information about road spacing is not published in a form that is readily available or easily understandable by the average logger or forester. One book written for foresters, however, presents a detailed description of the procedures used to locate, layout, and build different standards of forest roads directly in the field. Entitled *The Direct Location of Forest Roads*, by, T.A. Walbridge.

Finally, if you have questions about road spacing, particularly the more complex ones seek help from your state's forestry school or extension forester. If they don't have the answers, they can usually get them.

Shaving Bridge Costs

Most young foresters eventually wind up designing roads and bridges, and I was no exception. Two bridges – both disasters – stick in my memory. The first was designed for a contractor who could not read, so I drew a neat perspective view of one abutment showing logs, wing logs, and tie logs. I was careful to show all of the bull ends of the abutment logs downstream, so the bridge surface would be level. The bill of materials listed all of the logs, ties, wings, stringers, and decking.

One day the phone rang – "Sonny," the contractor at the other end of the line said, "I built the bridge like yer picture, but there's a mess of stuff left over." A quick trip in my pickup revealed the problem: he built one abutment, just as my picture showed, but he was standing on the other side of the stream when he looked at the picture. As a result, he put all of the bulls at the same end – upstream – and the bridge tilted a bit.

And, since my sketch showed only one abutment, he built one abutment, and had a pile of materials left over. We finished the bridge – which I hope has rotted by now – a monument to poor communications.

The second bridge of my career was equally bad. The opening size was calculated to carry the 100-year flood for that watershed, and the bridge was made as short as possible to minimize construction costs. As a result, the approaches were so steep that both empty and loaded trucks had to be pulled up the grades with a dozer. After a week, a second bridge was built on top of the first to reduce the grades. Sometimes we need to look at the forest as well as the trees.

How do you reduce the cost of building bridges? Don't build bridges! If you can avoid building them – do so by carefully comparing the cost of extra roads and eliminating bridges if you can. Often we have no choice, in which case we must build as cheaply as possible. There are many sources of help in bridge design, and one of the best is the U.S. Forest Service booklet, Permanent Logging Roads for Better Woodlot Management by Richard F. Haussman and Emerson W. Pruett, discussed earlier. Government got a big bang from our buck with this one.

Small bridges can save a lot of grief if shallow soils limit culvert size

Another source of help, particularly for figuring bridge and culvert openings to carry storm flows, is the Natural Resource Conservation Service (NRCS). The NRCS has offices in each state and will provide technical guidance with roads, trails, bridges, culverts, and erosion control. The NRCS has also published an excellent guide to erosion control and sediment, *Woodlands of the Northeast* by Robert E. Hartung and James M. Kress, also discussed earlier.

In the past, bridges were commonly built of materials near the site, but with tree size decreasing and truck weights rising, it may be difficult to find adequate stringers. Some loggers get around this by keeping some steel I-beams on hand and pulling them after each job is completed. Abutment material is usually readily available, as is decking. But there are some alternatives which you might consider.

The first is a portable bridge that you can pull up and move from job site to job site. These are typically constructed of steel, often in two or more sections that bolt together on-site. If you don't have a portable bridge, you will need to construct something more permanent – although there are short-cuts you can use. If adequate stringer logs are not available, consider propping the bridge while hauling is taking place. A prop in the center of the bridge will usually quadruple the capacity – which means that a bridge rated for 20,000 pounds may be boosted to 80,000 pounds. Make sure that the props are adequate to support the weight; pull them if high water threatens and at the end of the job. Props can catch floating debris, converting a bridge to a dam, and you can lose everything with heavy storm flows.

To prevent culverts from crushing, you should have at least a foot of fill over the top, which may not be possible in ledgy areas. A low bridge with a wide opening can often fill the bill. If built of railroad ties and ready-cut planking, you can install it easily and pull it and recycle it on completion of the job.

Another trick that is often used is to put extra stringers on the outside top edges of a bridge, using cables to tie them to the stringers below. In effect, the extra stringers nearly double the depth of the outboard stringers, greatly increasing the bridge capacity. To provide better load weight distribution on a bridge, lay the deck planking in a diagonal pattern and always put some rugged runner planks on top of the deck. Runner plank does the double duty of protecting the deck and adding a few inches of depth, thus more strength, to the stringers.

One caution to bear in mind with wooden bridges is that, unlike steel, wood is not uniform. Rot, decay, knots, and grain can greatly affect strength properties. Also, unpeeled, untreated stringers will decay with time. The bridge that held 55,000 pounds two years ago may not take 30,000 pounds now. Bridges are often a necessary evil in getting at timber, but good road and trail system planning may reduce the need for them. If all else fails and you must build bridges, get professional help. State and federal forestry offices, Corps of Engineers, NRCS – all have information that can help you. Don't miss out on it.

Trail Planning

Whether you are clearcutting, thinning selectively, doing a diameter limit cut or any other type of timber harvest, it is always a good idea to scout the operating area before work begins and lay out the best routes for skidding or forwarding. You should do this on bare ground when wet soils and ledge are not hidden by snow. In fact, if I had my druthers, foresters would be trained to properly locate trails and would do that first, especially in marked wood. Marked timber should be visible from the trail so that the cutter can plan his work, especially with mechanized felling.

Cable skidders can operate safely on slopes of 30-35 percent; grapple skidders are easier to tip over, and should be used on lesser slopes. In either case, by driving straight up or down the hill, you can take steeper grades. But, the usual advantage of steep trails – shorter distances – is quickly lost if you lose traction and then have to "crab" – or even worse – winch your way up. Better to drive a longer distance than lose time and rubber spinning your wheels.

It pays to walk the landscape before cutting any wood and choose the best route uphill to the timber. Once you hook on, a steep downgrade is not so bad, as your load will hold you back. But use a gentle winding route to climb, then make loaded return trips on a steeper, shorter grade. The only problem here is that erosion control on steep grades is next to impossible, unless you are on snow and frozen ground.

The principles of road construction outlined in the book *Permanent Logging Roads for Better Woodlot Management*, discussed in earlier sections, apply equally to skid trail construction, though skid trails can be much steeper – 30 to 50 percent. In steep terrain, cutting across, or traversing, the slope permits lesser grades.

Marked timber should be visible from the trail so that the cutter can plan his work, especially with mechanized felling.

Though traverse trails may mean a longer skidding distance, travel speeds will be higher, and costs will be lower. Most important, safety is improved. Winching skidders to the timber is unsafe and expensive, and roll-overs can also be unsafe and expensive. Even if your safety belt is fastened and you don't fall out of the cab during a roll-over, your ribs and other parts of your body will hurt for days.

If you regularly work in steep terrain, a crawler is a safer bet than a skidder (except in rocks), because it is far more stable. Consider bunching with a crawler (or portable winch) if skidding distance is long and use it to shape a good trail for the skidder.

Even in level terrain, it pays to walk the site and mark trails before skidding. When walking, it is easier to pick out the wet soils and obstacles that might be hidden by brush. Also, use a compass so your roads don't wander all over the sapworks. I recall one skid road – probably the worst one I've ever seen – which meandered through a large spruce thicket. Though the timber began about 150 feet from the landing, it took 350 feet of driving to get to it. That was an expensive and unnecessarily long skid trail, laid out from the skidder seat.

It also pays to clear trails before skidding unless you use different (one-way) routes in and out. The trees that you mash down on the way out are waiting, often at the perfect angle, to poke into the radiator or cab on the way back. This can also be a problem for feller-bunchers. Broken hydraulic hoses aren't so dangerous, but repairs and downtime are expensive.

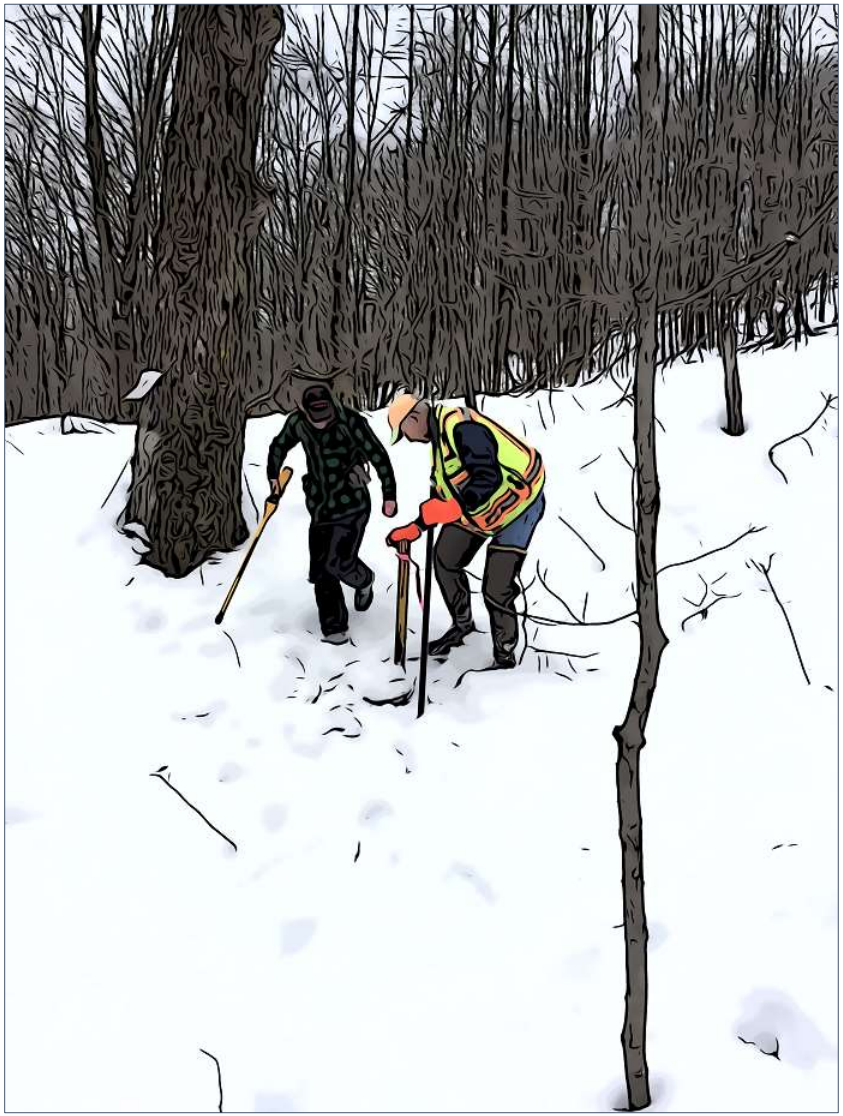
The same principles discussed in earlier sections about road layout and spacing apply equally to skid trails. With some extra care in trail layout, you can simplify bunching, maybe eliminate driving through the brush and slash "looking" for stems to choke. In easy terrain, try spacing your trails about four tree heights apart. Half of your stems will be within one tree length of the trail. If you fell the remaining half toward the trail, skidding tops first, you can reduce choking time. This means more slash in choking, which must be weighed against the benefits and it takes more power to pull tops first. Mix the trailside (butts first) and tops-first trees to cut choking time and balance the load on the skidder.

Take the extra time to lay out skid trails on your next job, just to see if it does make a difference. Suppose you spend a day – 8 hours – and only save 5 minutes per trip. In 96 turns, you will save the 8 man-hours spent in trail marking, plus an additional 8 hours of machine time, not to mention improving the skidder driver's disposition. It also improves the cutter's ability to place trees where the skidder can reach them easily.

You also leave a more professional-looking logging job after you're done, which becomes more and more important in today's world as environmental extremism threatens to dominate the way loggers and foresters make their living. Preplanned trails offer potential savings in cost, improved safety, and a more professional appearance to the job – values the modern timber harvester cannot afford to overlook. All you need is common sense, an inexpensive level or clinometer, plastic flagging, and shoe leather.

Chapter Seven

Some Legal Aspects of Logging



Whose Woods Are These?

Whose woods these are,

I think I know.

His house is in the village though.

He will not see me stopping here

To see his woods fill up with snow.

So wrote Robert Frost in his poem "Stopping by Woods on a Snowy Evening." Watching woods fill up with snow is one thing; filling them with slash is something else entirely. If you are cutting timber, you better know "whose woods these are," and their name and the address of thier house in the village better be on the timber sale contract.

Even before my childhood years – which my kids refer to as the "olden days" – timber trespass was common. Land was cheap, timber was cheap, boundaries were poorly marked (if at all), and many a dollar was made cutting timber belonging to somebody else. In the Lake States, the forty-acre lots established by the system of rectangular surveys were often called "rubber forties" for the boundaries were as elastic as a rubber band. Timber theft continues today, although to a lesser extent. Much of it results from poorly located property lines.

Most states have laws with penalties for cutting timber belonging to another. It goes by the polite term of timber trespass in some cases, or more simply – timber theft. In at least one state – Maine – the responsibility for establishing property boundaries is placed where it should be on the seller of timber. Maine law requires that the landowner clearly designate boundaries before cutting begins. Thus, the owner is responsible if his logger strays onto the neighbor's property. This is a good idea because loggers are often hard to track down after the cutting is finished.

Times have changed since the "olden days," and a person's word is less often his "bond." Many lawyers, in fact, do not consider contracts to be binding; if one party changes his or her mind, just break the agreement and let a court settle the matter. Once, while doing a boundary survey for an attorney, I could find no evidence of a thirty-acre parcel he claimed to own on the ground or in the tax maps. "Just find thirty acres and paint a line around it," he told me, "and we'll settle the matter in court." Sick!

If you are purchasing timber or land, you had better know – for sure – where the boundaries are. Have the owner mark them – especially if there is any question – and thus allow him to hold the bag if a lawsuit results. You will probably be named in the suit anyway, so check with your insurance agent to make sure you have proper coverage. If you mark the lines, on the other hand, you bear the total responsibility – and cost – for any mistakes. Most laws provide penalties of double or triple stumpage for timber trespass, especially if it was intentional. Unfortunately, in today's world, the logger is not regarded as highly, or as sympathetically, as in years past. Rural juries used to be lenient in timber trespass cases, often accepting wrongful cutting as being accidental. Today, rural populations and their attitudes have changed.

To more and more people, loggers are "damaging the environment," and they tend to be less sympathetic so even accidental trespass might bring heavy penalties.

Actually, there is no excuse for trespass by a "professional" logger.

Aside from trespass, "whose woods these are" is especially important for those who depend on stumpage from private lands. And to keep costs down and quality and production up, you must pay particular attention to your procurement methods. The closer to home and mill, the lower your costs, and the higher the quality, the higher your potential profit. Aside from the common "word-of-mouth" and "seek and ye shall find" methods, there is a more systematic means of acquiring timber, and it begins with maps.

U.S. Geological Survey topographic maps provide a wealth of valuable information. A log buyer could piece together a wall-sized procurement map from 1:250000 scale maps (about four miles per inch) or the older 15-minute quadrangles at a scale of 1:62,500 (about one mile per inch). The newer 7.5-minute maps are at a scale of 1:24,000, or 2,000 feet per inch. The average logger could paste up a good wall map of his principal operating area by gluing these maps edge-to-edge. Digital versions of the maps are often seamless.

USGS maps show highways, railroads, buildings, water bodies, and occasionally trails, plus contour lines showing topography. Forested land is colored green, which at least indicates where trees grow, but not necessarily what, how big, how good, etc.

If you are purchasing timber or land, you had better know – for sure – where the boundaries are.

Next, you need maps showing timber location by forest type, or species composition. Such maps, produced by the U.S. Forest Service, are usually included in published Forest Survey reports of your state, available on your state forestry agency's website. These maps are too large in scale (which means the map is small) for most work, but they can be blown up in a variety of ways. If you superimpose the forest type information onto your USGS maps, you have a good basis for timber procurement. Always ask if there are any larger type maps (smaller scale) available – you may be pleasantly surprised. They may even be available by drainage or inventory area.

Third, you need ownership information, best determined from local tax maps. These maps are usually at a small enough scale to be easily transferred to your topo sheets. Modern software makes this information available on many commercial mobile apps for smartphone. Another place to find ownership information is from government (state and federal) land management agencies. These organizations publish fairly accurate maps of their ownership boundaries. While getting information from them, also learn their policies about timber cutting. Many – the National Park Service is one example – do not permit commercial timber harvesting. If they do sell timber, it will normally be by bid, so see that your name is put on their mailing list for timber bidders. It is also wise to check in with local mills to find out where their lands are located, and their policies about buying and selling timber.

Once you obtain all available map information – topography, timber, ownership, etc. – make a base map by pasting the topo maps together for your area and transfer the timber and ownership data to it or reference it simultaneously on your phone. You can boil down, through the process of elimination, the available area and classify lands in three categories:

1) Inactive – agricultural and other non-forest lands, and forest lands (parks, wildlife refuges, etc.) closed off to timber harvesting.

2) Semi-active –forest lands under management by others, with timber sales controlled by others. Activities limited to periodic communication to "keep in touch," being on the list of active buyers/bidders. This includes government and industrial land, and private land managed by consultants.

3) Active – forest lands not managed by others. Operable, accessible, merchantable timber held by landowners who need to be approached and persuaded to sell their timber.

Now you are ready for the last step – checking aerial photos of lands in the "active" category to determine where the best timber is located. You can normally use the photos from a variety of online sources. Another option is low-elevation reconnaissance from a light plane or drone. Don't spend good money on photos, however, until you acquire timber and need them for road and sale planning.

In addition to serving as a base map, the topo map is useful for preliminary road planning. You can visualize the topography, possible access routes, obstacles to road building, and can even calculate grades. Air photos add the

ability to see the ground and timber conditions and locate roads where they will best serve the logging operation.

Finally, with appropriate apologies to Robert Frost:

Whose woods these are,

You'd better know.

And if you don't, you aren't a pro.

Just plot them there, on yonder map,

To save you time, and a legal flap.

Wood Measurement

Pity the poor logger who has bought Forest Service timber by the cubic foot, paid his crew by the cord, and the mill pays him by the ton. He is going broke. Is it poor management, or are the conversion factors wrong?

A Forest Service publication from some time ago listed more than 80 different ways of scaling the board foot content of a log, and these 80 rules had more than 200 different names. Scalers didn't have to grow long thumbnails to cheat you, the rules did it. Many of these rules are now history, but many are still in common use. In addition, we have other volume measurements — cords, units, cunits, cubic feet, cubic meters, and tons to name a few. Weight measurement is probably the most fair, but even weight varies with location, season, and the amount of time the log has been lying around.

Three of the more common log rules are the Doyle (a rule of thumb, or R.O.T.), Scribner (a diagram rule), and International (a mathematical rule recognizing log shape and taper).

In my recent travels, I found several problems related to the differences in log rules. A friend in Georgia just replaced his old circular mill with one of the small, portable band mills. He has been ecstatic over his new mill and claims huge increases in yield. For example, with a 1/16-inch kerf, he can saw an eight-inch timber into eight, one-inch boards. Though the boards are only 15/16, they are well made and can be finished into commercial "one-inch" boards. But it seemed a bit wild when he claimed that he could saw two thousand feet of lumber from a thousand feet of logs.

There are more than 80 different ways of scaling the board foot content of a log.

I pointed out to my friend that he was really getting much of this improved yield as a side benefit of using the Doyle log rule. His logs normally run from 10 to 16 inches in diameter. In this size range, the International rule is pretty close to the

expected lumber tally, but the Doyle scale runs 55 to 78 percent of International. His scaling, not his mill, is generating the "high" lumber yields, nearly double in the smaller diameters.

In Alaska, several friends were selling export logs to a buyer for a Japanese firm. In both cases, these men logged in winter when they could get to pockets of large, white spruce on islands and river banks. Ice bridges provide access to the timber. In the first instance, the logger trucked a load to Fairbanks 140 miles away, expecting it to scale out about 5,000 board feet. The slip was for 4,400. Why? The buyer was using a version of the Scribner rule, which ignores taper.

The export log specs called for 25 to 36-foot lengths, and the logs averaged about 3 inches of taper in 16-feet. Thus a 32-foot log that scaled 12 inches at the small end could be cut into two 16-footers – one scaling 12 inches and the other scaling 15 inches. But the Scribner is a diagram rule, based on diagrams of one-inch boards and saw kerf which can be sawn from circles of different sizes. This ignores taper. So my friend would be paid for two 12-inch logs, not a 12 and a 15. In this instance, a 12-inch log, 32 feet long, scaled 160 feet. In reality, you could saw nearly 250 feet from it.

The Scribner rule works well in old-growth timber where diameters are large and taper is small, and the decimal C version, rounded to the nearest ten board feet, simplifies the math. But in small diameters with a lot of taper, the log buyer has the advantage. Fortunately, my second Alaskan logger friend was still negotiating price. Armed with a set of log scaling tables, we persuaded the buyer to use a version of the Scribner rule which considers taper. We finally negotiated a favorable price, but the deal fell through.

These are just two examples of how variations in measurement methods can affect profits. Be aware of the methods used in your area, and take the time to scale loads periodically so that you know what you are selling. If you are selling on Doyle rule, be sure that you recognize the penalty for small logs, for you get hit two ways – first, the higher cost per unit to log small trees. Secondly, you suffer the lower scale from the Doyle rule. But, before jumping to conclusions about the Doyle rule, recognize that small logs also penalize the mill owner – his sawing costs are higher, and he is hit by lower grade recovery in small logs.

There is no perfect system for measuring logs. Weight may seem to be the most accurate, for it considers taper in sawlogs, but weight varies with season, site, and time since cutting, and it does not consider quality. Your only protection is to know the system used in your area and how it affects your production and costs. Also, if sawlog grading is practiced in your area, be sure to understand the relation between volume and grade and concentrate on maximizing dollar recovery.

One excellent source of information about log rules, conversion factors, and scaling/grading theory is an inexpensive booklet entitled, "*Log Rules and Other Useful Information*," (www.northernlogger.com).

Contracts

Many loggers grumble at the thought of a contract, but it is an essential part of any business transaction involving more than one person. I prefer to use the word "agreement," for that is the true value of a written contract. The purpose is to ensure that both parties clearly understand their rights and obligations. Then you don't have to rely on your memory of what you think they thought you said you would do, or vice versa. Never say "never" and never "assume" anything.

A timber sale or logging contract that clearly spells out the obligations of both parties eliminates any grounds for disagreement. The intent should not be to entrap either party – although that does happen – but should instead be to ensure that both parties are truly satisfied before, during, and after the operation. Agreements are to prevent problems, not to provide legal grounds for court actions. Only lawyers win in court.

Sometimes we are concerned about particular clauses in a contract; termination date is often a concern. If you, the logger, have doubts about your ability to complete a particular job because of weather, topography, or markets, insist on a provision for extension of time. If the seller won't bend, don't sign. There are very few instances in which two parties cannot get together if both are truly operating in good faith. If one party will not bend, they may want an unfair advantage – don't get hooked.

Written contracts are often signed reluctantly by one party, accompanied by oral (note I said "oral," not "verbal," because verbal can be oral or written) concessions by the other. A good example of this was a logger friend of mine who was not happy with the contract logging price but agreed reluctantly when the mill manager said, "If you run into trouble with that section of heavy blowdown, we'll make it right with you." How many times have you heard something like that?

Well, my friend signed, the blowdown was a problem for his tracked feller-buncher, and he lost money. The mill manager was no doubt sincere, but there was one small problem. About three months after the job began, another company bought the mill, and the mill manager now had a new boss and was walking on eggshells, hoping he would not be replaced. If you were his new boss, what would you say if he asked about paying $8,000 over and above the contract price for logging that blowdown area?

When I was logging, I always insisted on a written contract, and most landowners wanted one to protect them in case of logging accidents. But, one old-time timber owner didn't feel a contract was necessary. It was a fair-sized lot, about half softwood, half hardwood, and we agreed on a price per thousand board feet, woods run. But, I insisted on a contract. Under the agreement, I cut the softwood first, but when I moved into the hardwood, he wanted to raise the price. At that point, I was glad to have the contract, having cut the worst area and taken my lumps. Although the landowner was not happy at first, he was pleased with the end result, for my utilization and his total income were better than he expected. He had not thoroughly read and understood the

contract, a very common problem that often leads to a feeling of entrapment.

If you are subbing for another contractor, always read the original contract to understand what is expected with regard to logging and silvicultural practices. Many state and federal agencies require timber purchasers to assure that subcontractors have read and will comply with all conditions of the contract. To illustrate the problems that might occur, a sawmill bought a timber sale in Vermont and hired a logger to cut and remove the wood. When the owner's forester insisted that the logger treat freshly cut red pine stumps with borax (to control root rot), the logger was upset, because this was not in his contract. But when the forester showed him the sale contract with the mill, the logger complied, and the sawmill anted up more money to pay for the extra work.

A contract is an essential part of any business transaction involving more than one person.

Every contract should spell out several points in detail, namely:

1) Where the timber (lot, township, state) is located and how it is designated for cut (marked, designated by area, flagged/painted boundaries).

2) A map of the area, showing property lines, cutting boundaries, and road, trail, and landing locations should be a part of the contract.

3) Species, merchantability, volume, grade, and price (stumpage or logging) should be specified. Specs such as stump heights, top diameters should be included.

4) Provisions for paying performance bonds and stumpage, or for contract work.

5) Who has title to standing timber and cut products, and who pays taxes on the same (if applicable).

6) Slash lopping/removal, road/trail/landing maintenance during and after operations (including liming, seeding, mulching), fire protection/suppression.

7) Road/trail/landing specs – bridges, culverts, waterbars.

8) Care in logging – restrictions on equipment, length of timber, pre-bunching, etc.

9) A provision for extending the contract, subject to reappraisal of prices.

10) Provisions for amending and canceling the contract.

11) Date contract begins and ends.

12) Any other pertinent factors.

13) Signatures and witnesses.

This list covers only basic points, not all of the specific details that might be required for a particular owner, area, or condition. But, if these points are covered completely, there should be no grounds for disagreement, and the contract document serves as a basic logging plan. For questions arising after the contract is signed, both parties should agree on how they are to be addressed and sign a written amendment. A sample timber sale agreement is included at the end of this publication. Above all, when doing business with relatives and friends, have a written agreement.

Environmental Laws

Our industry faces an ever-growing mountain of environmental laws. Some good, some not so good. Some people just oppose the cutting of trees. They do not understand that trees grow, nor do they see the linkage between logging and the wooden houses, furniture, hardwood floors, and toilet paper they use. Even if toilet paper eventually hits $2.00 a roll, they will pay it.

Most regulations actually benefit both our society and our industry, and our failure to voluntarily practice good management has led to many of them. We have only ourselves to blame for these laws and their "restrictions," and unless we clean up our act, there will be more. Mud on highways where log trucks enter, muddy streams, sloppy looking clearcuts next to highways or on highly visible hillsides, unsightly logging slash, wasted timber, barber-chaired stumps, rutted roads and landings, empty oil cans and rusty cables strewn around, poorly stacked and chained loads on the highway – all of these upset the public – not to mention the growing number of people who can't bear the thought of "killing" a tree.

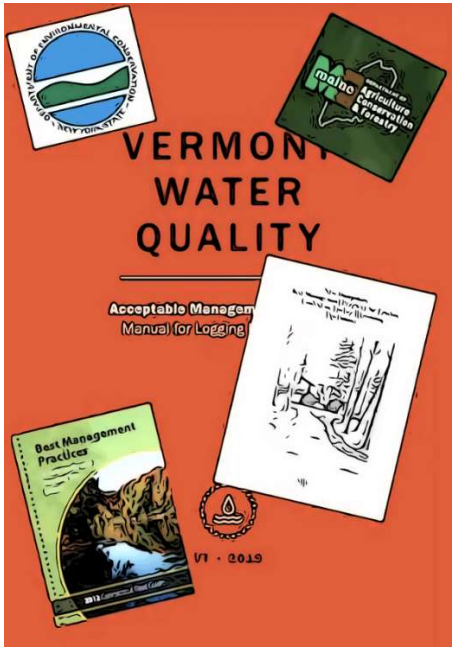
If loggers think they have a hard time, foresters are having it just as tough because they too did not recognize changing public opinions and demands. Foresters, those great protectors of the environment who rescued Smokey the Bear, rode around on white horses or sat in fire towers, have lost credibility with environmentalists because of their belief that the forest should be used. To the public, scientific reasoning no longer counts – "who's right" counts for a lot more than "what's right" in the current debate. Most regulations are reasonable, and in the long run, we will benefit by complying in a professional manner. The majority of problems result from the misinterpretation of rules by inexperienced or overzealous people in charge of enforcement, but their hardnosed attitudes often reflect our own stubbornness. If we are negative, uncooperative, or unfriendly, our lives will just be more difficult. Make up your mind to comply, then seek the path of least resistance. There are several steps on the road to achieving this:

First, eliminate the element of surprise. Check all of the governmental jurisdictions in which you work – state, county, municipal – to find the laws (state) and ordinances (county and town) that might affect your operations. Go to the offices that administer the laws (or their websites), get copies of them, and find out what you must do to comply. Show a willing, cooperative attitude. Meet the people who will be enforcing the laws and find out what they expect; have a nice business card when you introduce yourself.

Before doing any of the above, you should visit your local service forester to find out what he or she knows about the laws and those who administer and enforce them – you may get some helpful tips on both the local laws and personalities. Next, study the rules and regulations that affect you. Are permits and applications needed? How far in advance? Do they require public hearings? Most forms call for information that should be a routine part of your planning – maps, timber types and volumes, nature of cut, sequence of operations, road and trail construction and maintenance, cleanup provisions, erosion control, dates of

beginning and completion. Get samples of all forms and become familiar with them.

If you need a permit, allow enough lead time for the administrative process before you expect to begin operations. Board or public hearings add more time to the process. Be sure that the needed information is complete, clear and concise, and include some neat maps. Be prepared to clearly explain your plans and to offer alternatives to anything that may be controversial. Discuss your plan with the public administrators before turning it in – be sure you haven't missed anything. You might even eliminate some surprises later.



How to stay at peace with your government.

We have all heard horror stories about inspections and enforcement. Some negative personalities just gravitate into these jobs because they enjoy the power, however small, of their job. These folks can be antagonistic, nasty, and downright impossible to satisfy. It is frustrating, and your only choice is usually patience.

If you have a good reputation and are friendly, cooperative, and professional, the people behind the regulations will help you, with few exceptions. If you test them, they will watch you and wait for an excuse to challenge you. In a society with a surplus of lawyers and a government in which most elected representatives are lawyers, accept the fact that the situation is likely to become worse. It will not go away – learn to live with it.

New York State's Adirondack Forest Preserve was created in 1885 because of public outcry over forest practices. Similar actions have occurred in other states. Instead of looking at these "preserves" as a pain, we should consider them as warnings. The public forest land base for commercial use is constantly decreasing and will continue to do so. And since the public cannot buy all land, it will enact laws to control our use of private lands. By and large, these controls are needed, but many result from our ignorance and/or unwillingness to change.

Having worked in government for 12 years, it frightens me when the public sector takes more control over land use. The way the system is structured, more control means more frustration for business, at more cost to the taxpayer. Sadly, most controls are not only frustrating and costly but are also

ineffective in achieving their goals. Our best defense is to educate the public and lead with "best management practices."

Unfortunately, if this were a football game, it would be third and 25, on our 3-yard line, with eleven minutes to play and the score at 38-14—in their favor. But we have the ball!

Note: The following is a sample timber sales agreement, designed to give some idea of what a timber sale contract should contain. Always make sure that any timber sale agreement takes individual needs and circumstances into account. It is a good idea to check with an attorney before signing any contract. **THIS IS NOT LEGAL ADVICE**

SAMPLE TIMBER SALES AGREEMENT

AGREEMENT: Entered into this __/__ /__ between _____ hereinafter called the seller; and _____ hereinafter called the purchaser.

WITNESSETH:

Article 1:

A. The seller agrees to sell to the purchaser upon the terms and conditions hereinafter stated all merchantable timber which is marked or designated by the seller or his agent on the lot in the Town of _____ County of _____ State of _____

B. The seller stipulates that (he/she/they) is (are) the sole owner(s) of said tract of timber and has (have) the full right and power to dispose of said timber in the manner specified within. The seller agrees to guarantee title to the forest products covered by this agreement and to defend it against all claims at (his/her/their) expense.

C. The seller further agrees to allow the purchaser to enter upon the above-described premises with his equipment for the purpose of cutting and removing therefrom such timber as is included in this agreement.

D. The seller shall be responsible for clearly designating the boundaries of his property within 200 feet of the area to be cut.

Article 2:

A. The purchaser agrees to pay the seller for the said timber at the following rates:

1. Sawlog Timber (MBF = 1000 Board Feet) _____

2. Pulpwood Timber _____

3. Boltwood _____

4. Other Products _____

5. A deposit of $_____ shall be required before operations are started. Money deposited prior to cutting operations shall be applied to stumpage due the seller(s) at the end of the cutting job or contract period whichever comes first. Timber shall be measured by the mill to which wood is delivered. Payment for all timber shall be based on the scale of purchasing mills. Copies of the mill scale shall be provided to the seller with each payment. Payments will be made on a (weekly) (monthly) basis as the timber is removed.

B. The purchaser further agrees to cut and remove the timber in accordance with the following conditions.

1. Unless an extension of time is given in writing by the seller(s), all timber shall be cut, removed, and paid for by _____

2. The trees to be cut shall consist of softwood and hardwood timber that has been marked for cutting with paint on the stem and also on the stump. No trees shall be cut unless marked for cutting (unless provided for as follows):

3. All trees must be utilized to their smallest top diameter for commercial products: Sawlogs - inches; Boltwood - inches; Other products - inches.

4. Stump heights shall be cut as low as possible but in no case shall exceed one foot in height. In case of deep snow, stumps must be shoveled before cutting to meet this requirement.

5. Slash from the cut trees shall not remain more than five feet above ground level.

6. Care shall be taken of young reproduction and trees that are not marked for cutting to minimize damage to them.

7. Care shall be taken at all times by the purchaser, his employees, and sub-contractors against fire.

8. All applicable legal requirements shall be observed, including without limitation, requirements relating to brush disposal and litter control.

9. Purchaser and any contractor acting under contract with purchaser who enters upon the premises shall carry public liability, bodily injury, and property damage insurance and automobile liability, bodily injury, and property damage insurance while operating on seller's property in amounts adequate to protect seller(s) against any such claims; and purchaser and such contractors hereby agree to indemnify and hold harmless the seller(s) against any such claim.

10. The purchaser shall be responsible for all payroll taxes, Workers' Compensation Insurance, social security, etc., and any other employer-and-employee-related costs. Purchaser also will follow Fair Labor Standards regulations and any other applicable regulations and will supply certificates of insurance to the seller.

11. Stumpage prices agreed upon at the signing of this contract are based on current market conditions. If during the life of this contract market conditions change so they work a hardship on either the seller(s) or purchaser, the stumpage price may be revised by agreement of both parties. Stumpage prices will be reviewed as necessary during the life of this contract.

12. All timber included in this agreement shall remain the property of the seller(s) until paid for in full. All operations on the designated area may be suspended by the seller(s) if conditions of this contract are violated. Continued violations of the terms of this agreement shall be sufficient cause for its termination.

13. It is understood that the purchaser is an independent contractor and is neither an agent nor employee of the seller(s) for any purpose whatsoever.

14. This agreement shall not be assigned in whole or in part without the written consent of the seller(s).

15. The authorized representative of the seller(s) shall inspect harvesting as it is done. The presence of this representative will in no case relieve the purchaser of his responsibility for performance of the terms of this agreement.

Article 3: Special Provisions of this Contract:

_____
_____
_____
_____
_____
_____

Witness: _____ Date__/__/__

Seller_____ Date__/__/__

Witness: _____ Date__/__/__

Purchaser_____ Date__/__/__

About the Author

Benjamin Hoffman, Jr.

Benjamin F. Hoffman, Jr., born on February 11, 1930, in Hagerstown, Maryland, was a multifaceted professional with a career spanning the military, forestry, academia, and writing. He earned a B.A. from the University of Virginia in 1951, served in the Navy, and later obtained his MF from Yale in 1957, followed by a Ph.D. in 1982.

Hoffman's professional journey included roles as a Navy officer, logger, forester, surveyor, and professor at the University of Maine. Post-retirement, he volunteered in forest technology in British Columbia and Alaska and consulted in forestry and wood products. He authored a logging handbook, *'How To Improve Logging Profits'*, and over three hundred articles on various subjects. In this work he developed a close and productive work relationship with the late editor of *The Northern Logger and Timber Processor*, Eric Johnson. Hoffman's commitment to his field was evident in his licensures and certifications in forestry and land surveying.

Benjamin F. Hoffman, Jr. passed away on December 28, 2019, leaving behind a loving family and legacy of significant contributions to forestry and education, along with a lifelong passion for model railroads and a belief in the value of every day being Earth Day.