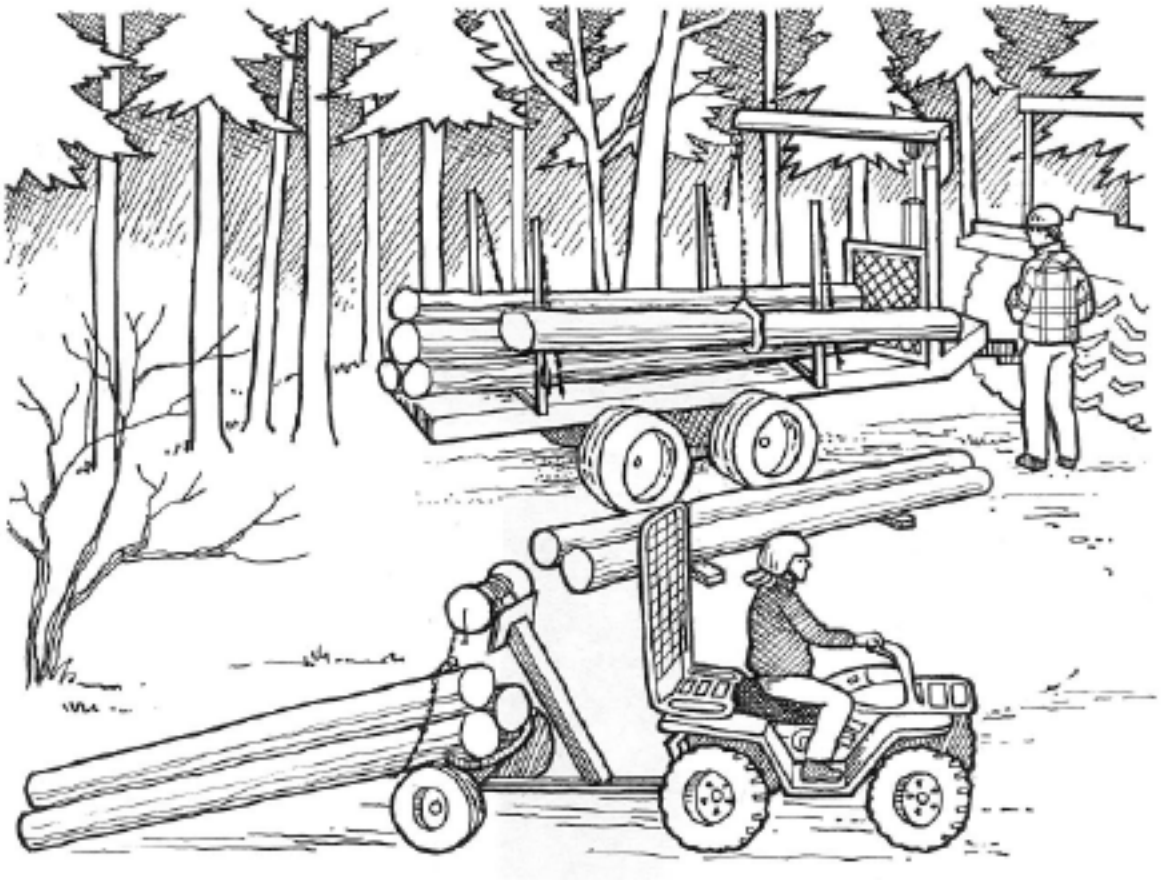
WOODLOT MANAGEMENT HOME STUDY COURSE



MODULE 12

Small Scale Harvesting Equipment

NOVA SCOTIA
Natural Resources

Manual HSC 2006-1

PREFACE

This Home Study Module is for woodlot owners who want to harvest wood from their land themselves. You may be doing this already but are ready for more up-to-date equipment or more efficient attachments. Or you may be a new landowner who has no equipment or experience. In either case, this module will help you decide what equipment is right for you.

The module deals with small scale equipment suitable for harvesting wood for your own use and perhaps some to sell. It may also be useful if you plan to cut larger amounts and have lots of time but do not want to invest in large scale equipment.

The seven lessons provide basic information on different types of equipment and attachments, and skidding and forwarding systems. The goal is to help you make a decision rather than provide complete technical details. After reading the module and doing the exercises, you will have a good idea of what systems will work well for you and your woodlot. You will also know how to work with your small equipment and where to go for more information.

Small Scale Harvesting Equipment - What's Right For You? is part of the Woodlot Management Home Study series produced by the Nova Scotia Department of Natural Resources (DNR). This series of modules is meant to help woodlot owners make informed decisions about the various uses of their land. Some are referred to in this Module. See Appendix A.

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Illustrations by Elizabeth Owen and Gerald Gloade
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Photos by Sheena Masson

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TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

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PHOTOS

CHARTS

LESSON ONE:
DECIDING WHAT'S RIGHT FOR YOU

So you are ready to harvest wood on your land or improve your current equipment. Many factors need to be considered when deciding on a small scale harvesting system. It is wise to spend some time reviewing these factors so that the equipment you choose will be suitable for years to come. Keep in mind that there may be more than one system that will work well for you and your woodlot.

Lesson One looks at your woodlot objectives and other important considerations. At the end, you will have a good idea of what your main piece of equipment will be. More information on setting objectives for your woodlot can be found in Module 1A: Getting More from your Woodlot - An Introduction to Integrated Resource Management.

While many woodlot owners likely have some knowledge of harvesting equipment, others may be unfamiliar with it and the various ways it can be used. This lesson begins with a brief overview of the two commonly used machines and two attachments. Use cords per year (or metres cubed (m^3) stacked) as a rough guide only as amounts may vary from year to year. Costs are based on 2006 prices.

BASIC EQUIPMENT

ATVs

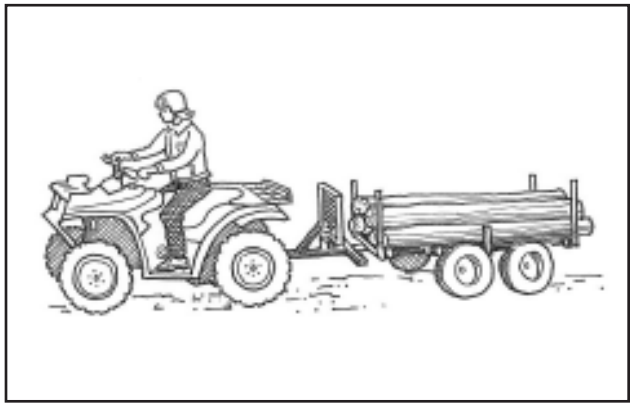
ATV stands for All Terrain Vehicle, also known as a four wheeler. These are common in the woods of Nova Scotia and

mostly used for recreation. They were originally built for farm and woodlot use.

The advantages of the ATV are its versatility and relatively low cost. The small size and maneuverability can allow you to get close to the cut log. The disadvantage is that it is less powerful than a tractor and so production is lower.

An ATV may be a good choice if you want to harvest a small amount of wood per year (1 to 20 cords /4 - 70 m^3).

An ATV can be used for forwarding and skidding. It is also good for many recreational uses like hunting or hauling supplies to a camp.



1.1 ATVs are useful for harvesting small amounts of wood.

If buying an ATV, look for one with maximum ground clearance and a minimum 300 cc engine. The cost of a new ATV that can handle woods work begins at about $8,000.

Tractors

Tractors typically can produce more than an ATV and are more commonly used in Nova Scotia for harvesting wood on a small scale. They are a versatile machine for the landowner who may also want to farm, clear snow or brush, or run other accessories like a splitter. They are adaptable to many harvesting attachments and it is easy to get parts and service. Many forestry attachments have been purpose-built for farm tractors. Tractors are proven in the woods and have good resale value.

A tractor is best for medium to large amounts of wood (20 to 100 cords per year/70 - 360 m^3) but could also make sense for less than that if you have other uses for it.

Tractors come in three groups based on Horse Power (HP): 20 HP which is a minimum but enough for small amounts, 40 - 75 HP which is most common and 110 or more HP which is harder on fuel and may not be cost effective. A new 20 HP tractor is about $12,000 with another $2,000 for the winch. Basic modifications for the woods can add another $7,000 (see Lesson Two for list). A tractor over 60 HP will not be taxed. If you buy it with a cap and loader already attached, you do not pay tax on either since they are sold as a package.

A minimum 50 HP engine (or 30 HP diesel) and a Four Wheel Drive (4WD) is recommended if you plan to make a living from the harvested wood. A 4WD has better weight distribution between the front and rear axle and so front-end rearing is less likely. However, a 2WD can work too with extra attention to prevent this.

Another option is to buy a used tractor. A used 65 HP tractor costs about $16,000. Sources of new and used equipment are listed in Appendix B. Other equipment options are mentioned in Lesson Four.

What other equipment options do you know of ?

_____

_____

_____

_____

_____

1.2 A tractor has enough power to skid large logs.

Winches

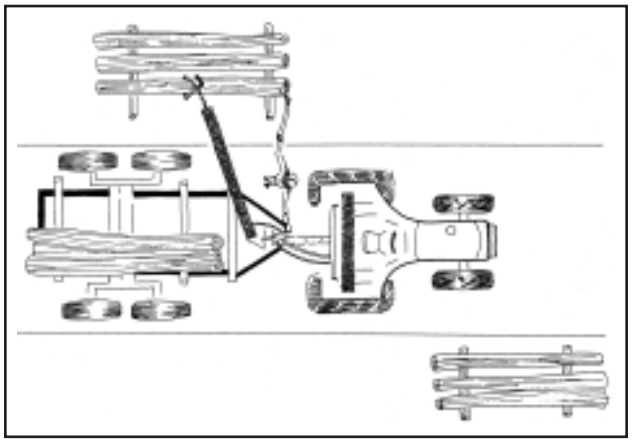
A winch can be attached to a tractor, a trailer, a sulky, a skidder or less commonly stand alone. It consists of a drum and a long cable for dragging the log toward the power source. The cable is attached to the log and then winds in over the drum.

Winches come in many sizes and pulling capacities. Winches used with ATVs can be manual, electric, gas powered and hydraulic. Typical tractor models are powered by the Power take off (PTO) or auxiliary hydraulic ports.

It is important to understand what power sources are available on your ATV or tractor before selecting a winch. Purchase a winch that is compatible with the power source on your equipment. Prices range from $80 (for a simple manual winch) to $6,000.

Trailers

Trailers also come in many sizes and load capacities. You can load the trailer by hand, use a winch and boom combination, or a grapple loader. Be sure to select one that your equipment can pull safely when fully loaded. You may also decide to build one yourself or have one built.



1.3 Trailer with a winch and boom.

Some trailers have power supplied to the wheels from the tractor. If you have a pickup truck but no tractor, you can use the pickup to haul a trailer on a D Class road (depending on road conditions).

Winches and trailers are covered more in Lesson Three along with other attachments.

SMALL SCALE HARVESTING

Harvesting equipment can be used in different ways and combinations to get your wood roadside. A visit to a local woodlot to watch equipment in action is invaluable for understanding how the equipment actually works in the woods.

Felling the wood is described in Lesson Five. It can be cut into short wood or tree length depending on what you plan to use it for. This will also determine what attachments you use in terms of skidding and forwarding.

Moving wood from stump to roadside involves “skidding” or “forwarding” and sometimes both depending on distance.

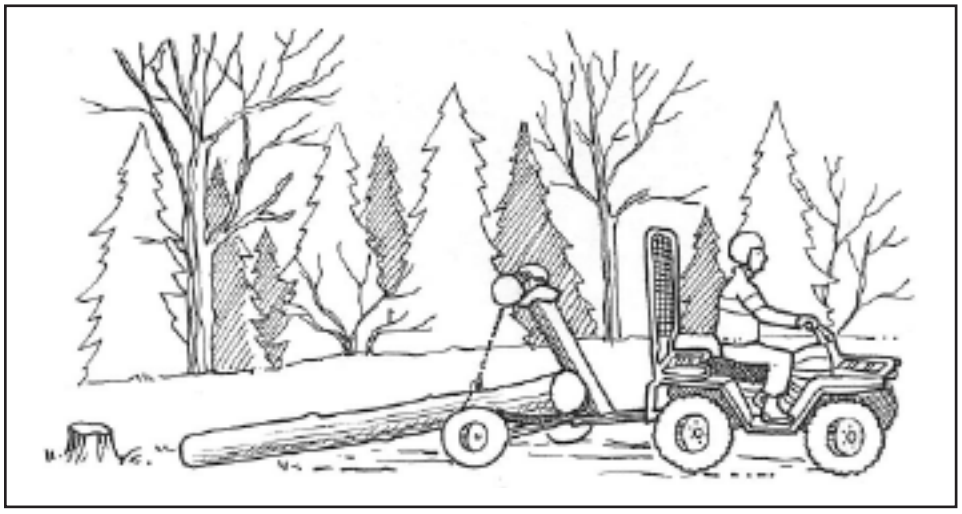
Forwarding

Forwarding wood is when no part of the log touches the ground. The logs are either loaded on a trailer or somehow supported at both ends.

Skidding

Skidding wood is when one or both ends of the log touch the ground. Skidding is further broken down depending on the equipment used.

Three types of skidding: Logs piled for picking up or processing



1.4 Skidding with a log arch

Pulled

When a simple cable is attached to equipment and you must move the equipment to move the log, it is being "pulled".

Winched

When you use a manual, electric or hydraulic winch to move the log closer to your machine, the log is being "winched". Both ends of the log are on the ground.

Skidded

When on end of the log is suspended or carried (in an arch or sulky etc.) and the other end is on the ground, the log is being "skidded".
This can be done in one or two stages.

Stage One: The log is winched to your machine. At the machine, one end is raised, then skidded and added to a pile on a main trail for final pick up or processing (processing could be milling, bucking or splitting).

Stage Two: Sometimes, this pile is loaded onto a trailer and forwarded to a main landing. Logs are assessed and sorted here for off-site transportation or processing.

Small scale compared to large scale equipment

Benefits	Disadvantages
Lower capital costs	May require more skid trails
Lower operating costs	May require more operator skills
Can have multiple uses	More labour intensive
Easier to transport	Safety concerns
	Lower productivity

WHAT'S RIGHT FOR YOU ?

The following four factors need to be considered when deciding what is right for you.

1. How much wood do you want to harvest?

If you have a management plan, you may already know your projected harvests. If not, you may still have a good idea based on past harvests. It may be as simple as how many cords/m^3 of firewood you need each year. Or you want to get a minimum income every year from your woodlot. The amount per year will probably vary but try to figure out an average.

Always consider how much wood you can harvest sustainably from your woodlot. A good rule of thumb is that a productive, managed forest can grow one cord per acre per year.

Is this amount going to change in the next few years? Perhaps you are planning to buy an additional woodlot and cut more wood for sale. Take this into account as well.

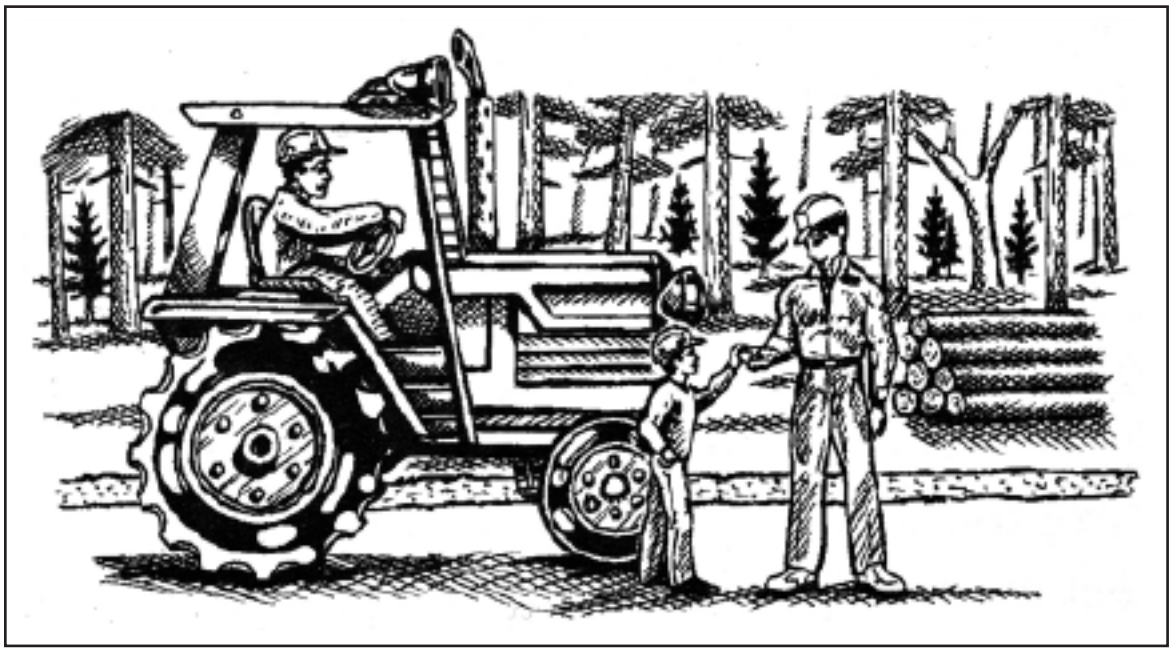
2. What products do you plan to harvest?

You may want to harvest firewood, sawlogs, pulpwood or other products like Christmas trees. Using small equipment and doing the work yourself may make it easier to harvest "specialty" products for artisans and wood workers.

If firewood is your main requirement, then an ATV may be enough if you do not already have a tractor. You may thin out some smaller trees which can then be used for firewood. Smaller diameter wood is easily handled by an ATV.

If you are harvesting firewood commercially, a tractor may be better as it has more power and can haul bigger logs. Do you plan to cut sawlogs to make lumber for yourself or to sell? If you plan to cut a lot of large diameter sawlogs, again a tractor may be best.

Woodlot owners who plan to clearcut areas of their land every year will need a tractor. If you have a large area to cut, hiring a contractor may be more economical.



1.5 What you plan to harvest and how much will determine what equipment is best for you.

3. How much should you spend?

For most of us, the first answer will be "As little as possible". But as purchases involve both costs and benefits, it is not that simple.

1.6 Both costs and benefits need to be considered when deciding what to buy.

Is it important to you that the operation pays for itself or makes money? If so, you need to figure out value of the benefits: roughly how much the machine will save you (in firewood costs for example) and make for you in sales each year. If you are using your ATV or your tractor for other uses, then that should also be considered on the benefit side.

Then balance that against the cost of the equipment as well as operating and maintenance expenses. As one contractor advised, it's not how much you cut but how much you have made at the end of the day. Lesson Seven provides a chart to help you evaluate your financial factors.

Some small woodlot owners may not be too concerned about whether their equipment makes money or even pays for itself. The enjoyment, satisfaction and independence they get from harvesting their own wood offsets the cost .

> ***" The lower fixed costs of small scale equipment can more than compensate for its lower productivity, resulting in increased net revenues per harvesting unit." Applications of Small-Scale Forest Harvesting Equipment in the US and Canada, Page 5.***

4. What is your woodlot like?

Site considerations are another factor in choosing harvesting equipment. If you have a lot of steep slopes or big trees, a tractor and a winch may be a better choice than an ATV. Certain attachments such as trailers do not work well in rough terrain.

Stand composition also needs to be considered. Do you have mature areas that need to be clearcut? In this situation, small scale equipment is less productive. Or do you have an uneven aged forest where you do selection cutting and thinning? Under certain conditions like thinning, small equipment may be more suitable because it is more maneuverable and may do less scarring to remaining trees.

Harvesting in wet areas or riparian zones requires planning and an understanding of current regulations. If you do harvest there, small equipment may be more maneuverable. Using a winch and boom can reduce the need to physically take equipment into these sensitive areas.

In soft or shallow soil, it is important to avoid compacting or rutting the ground. This depends less on the size of equipment used than on pre-planing, tire width, extraction system, operator skill and ground conditions. See Lesson Seven for more information on reducing environmental damage.

YOUR OBJECTIVES

Check off your objectives for buying or improving your harvesting system.

_____ To harvest _____ cords/m^3 per year.

_____ To harvest firewood

_____ To harvest sawlogs

_____ To sell _____ cords/m^3 per year or earn $_____ in income.

_____ To maintain forest cover with selection cuts

_____ To maximize income from my woodlot

_____ To spend time in the woods doing productive and enjoyable work

_____ To get a system that requires as little lifting as possible

_____ To get a system that is as inexpensive as possible

_____ To do the work myself

_____ Other

_____

ADDITIONAL DECISIONS

By now you have a some idea of whether an ATV or tractor woudl be best for you. Here are a few more factors to consider. Other options for your main piece of equipment are in Lesson Four.

To modify or buy?

You may already own a machine that you are using for woods work or other uses around your property. Perhaps it is getting old or worn out. Or you may own an old truck that you could convert to a truck tractor? The question is: Can it handle your woodlot needs? Is it suitable for woods work? Power requirements are generally low if the gearing is low, and less power can also mean less machine breakage. Can it work with some changes to the system? Is it adaptable to a bigger trailer or attaching a winch?

If not, you need to consider buying a new or used machine. Make sure it will be compatible with the attachments you plan to use. Do some research. Talk with some fellow woodlot owners about what models work well for them. The Internet is also a good place to research different models of ATVs and tractors. Some excellent publications are listed in Appendix A and they are available for loan.

Where to buy?

Ask local equipment owners for retailers they recommend. You can also look in the Yellow Pages in the phone book under ATV, Tractor or Logging Equipment. Most areas of Nova Scotia have an ATV retailer. If you want to buy a second hand ATV, also check used truck magazines which are widely available in Nova Scotia.

Check retailer and used equipment ads in local forestry magazines (See Appendix B). You can look through a copy of **The Green Pages**, a directory of equipment dealers, contractors and consultants at your local DNR office.

Companies that sell new tractors sometimes have used tractors (trade-ins) for sale. You may also be able to find used equipment at small local dealers.

Do it yourself or hire a contractor?

Photo 1.1 Small local dealers may be a good source of used equipment.

Other considerations are your level of skill and the time it will take you to do the work. If you are new to harvesting, it may be safer, faster and more profitable to hire a contractor for part or all of the work. For example, the contractor could cut and skid the wood and you could forward it. Or you could cut it and have a contractor forward it.

If you have a large one-time harvest to be done, it may make more economic sense to hire a contractor than to buy or use your small scale equipment. This way you get the work done quicker and the money in hand. It may help pay for some smaller equipment so you can continue to cut small amounts yourself year to year.

Before you hire the contractor, get an estimate of how much wood and what type of products will be cut. It may be mostly pulpwood or a mix of pulpwood and sawlogs. Consider getting an independent estimate for the standing wood to be harvested AND for the final roadside amount.

Choosing a contractor

Talk to local woodlot owners to get their opinion of some local contractors. You can also look in the Yellow Pages or contact your local DNR office. Contractors are also listed in local forestry magazines. See Appendix B.

When you talk to the contractor, ask for some references and call them too. Keep in mind it may only be possible to harvest when the ground is frozen or dry. Show the contractor your property and the area to be harvested. Discuss your expectations and harvest options. This will give you an understanding of what the forest will look like after harvest and if you want this contractor to do it.

It is also a good idea to get the contractor to sign a contract though this is not common practice. This will protect you and the contractor. Also get a third party to witness. Are you the sole owner of the property? If not, the contractor will ask you to get the other owners to sign as well.

You will likely need to create the contract yourself. Refer to *"Hiring a Contractor"*, Page 23, *Module Two: Harvesting Systems* for a list of points to cover in the contract. Also, a brochure called "Selling Standing Timber" may be helpful and is available at all DNR offices.

It is important that the contractor is covered by Workers Compensation. Once you have an employer/employee relationship with the contractor, Workman's Compensation and associated regulations come into effect. This may have an impact on what equipment is suitable for both harvesting and legal requirements.

EXERCISE 1.1

Fill in your situation underneath as much as possible at this point. We will return to it at the end of the Module.

Have equipment *(List)*	**Do not have equipment**
Equipment adequate/ Not adequate *(List what is and is not adequate)*	**Decide what you need**

For example:

I have a tractor, winch and trailer.

My tractor is adequate.
My trailer is too small for my planned harvest.
My winch is worn out.

I need a new winch and a bigger trailer.

LESSON ONE QUIZ

(*Answers are on last page.)*

1. A winch can be attached to:

a) A trailer

b) A tractor

c) A skidder

d) It's own stand alone frame

e) All of the above

2. Small scale equipment is:

a) less productive than large scale equipment

b) more productive than large scale equipment

c) it depends on the conditions

3. When deciding on what equipment to buy, get all the costs and pick the cheapest.

_____ True

_____ False

4. The steepness of your land is a factor in choosing the right equipment.

_____ True

_____ False

5. Which of the following factors are important when deciding whether to modify your current system or buy another one.

a) Is it powerful enough?

b) Can it handle the amount to wood to be cut?

c) Is it adaptable to new attachments?

d) All of the above

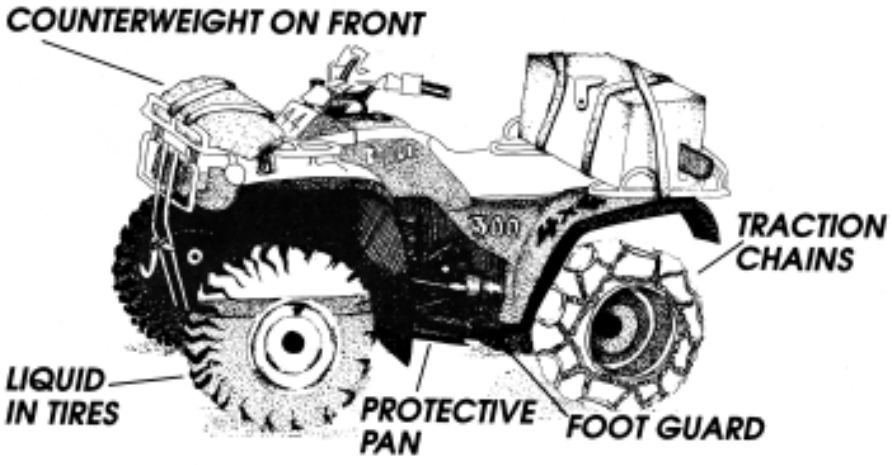
LESSON TWO:
MODIFICATIONS TO YOUR ATV OR TRACTOR

This lesson deals with modifying your ATV or tractor so it is better suited to woods work. ATVs and tractors are not designed specifically for harvesting wood. They can be damaged by rocks, stumps and other obstacles. They can roll over if they get unbalanced or the driver is not cautious. Certain modifications can improve traction, protect your equipment and make it safer for you to operate.

MODIFYING YOUR ATV FOR WOODS WORK

1.	ATV chains on the rear wheels (This can also cause the ATV to catch and flip over. Use caution.)	Improves traction and braking
2.	Liquid in tires (Use windscreen washer fluid, and fill 2/3 through tire valve. ATV will handle differently.)	Reduces rear and sideways rollovers
3.	Weight on the front (Use a sandbag or toolbox)	Reduces rear rollovers

! These modifications are important for safe handling in the woods BUT they can invalidate the warranty for your ATV or parts of it. Check with your ATV dealer first.

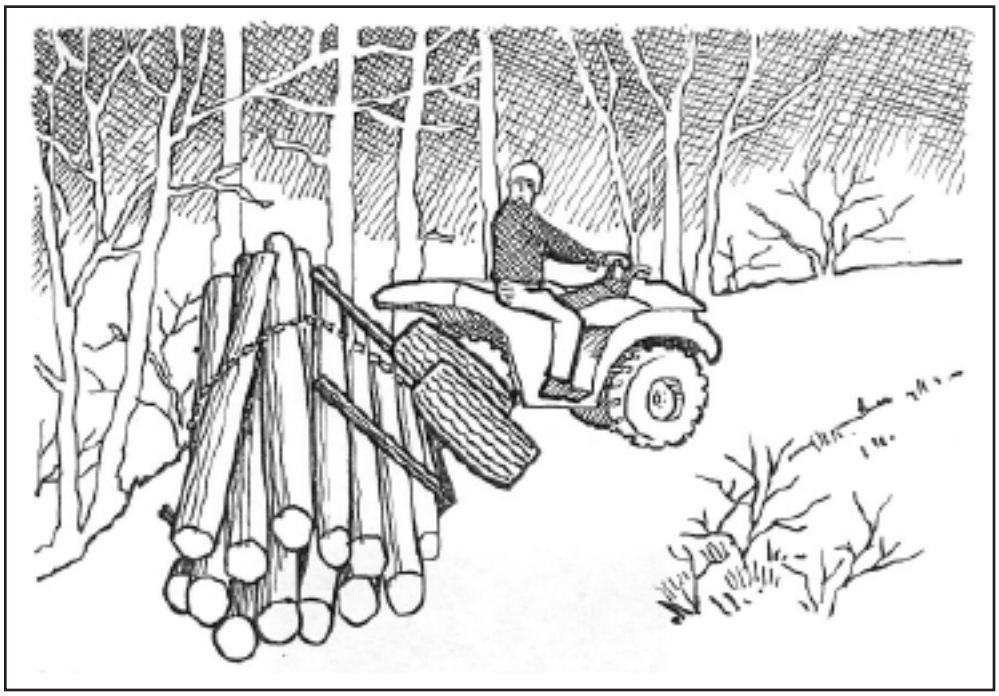


2.1 ATV with modifications

Additional Protection

1. Front bumper
2. Protective pan under the engine
3. Foot guards
4. Recovery winch (electric or manual) if you get stuck
5. Roll cage

! Keep your feet on the foot pegs and wear an approved ATV helmet.



2.2 A rotating hitch saved this driver from overturning too.

! It is a good idea to use a rotating hitch to connect to the trailer or other attachment. The attachment can tip over, and not roll the ATV and you! with it.

MODIFYING YOUR TRACTOR FOR WOODS WORK

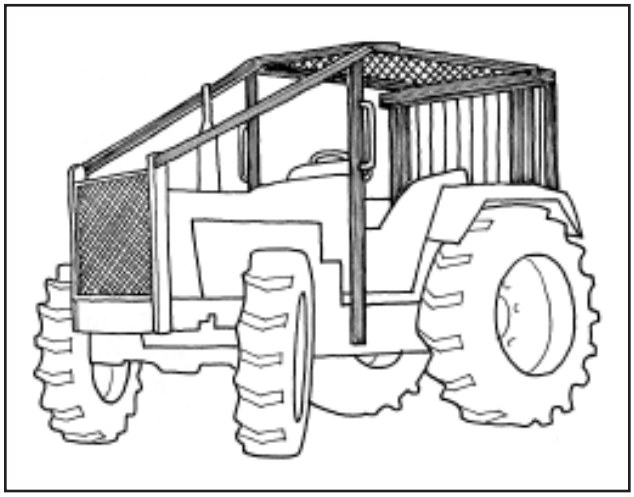
Roll Over Protection Structure (ROPS) and Falling Object Protection Structure (FOPS)

Any equipment used in the woods should have a braking system, ROPS and FOPS.

Rollovers - sideways and backwards - are the main hazard when using your tractor for woods work. Tractors are not designed for uneven terrain plus the load can cause them to upset.

Tractors with a cab may have a frame that acts as the ROPS. Make sure it meets roll over standards (Canadian Standard Association Code for Rollover Protective Structures).

You can add more protection with a super structure that goes over the cab. Tractors without a cab should have a ROPS structure installed if there is not one already.



2.3 Upper protective structure over tractor without a cab

Modifications to the ROPS must be certified by a professional engineer have or written approval from the manufacturer.

FOPS are also a requirement for forestry equipment. The structure is to protect the driver if a tree falls on the tractor and it should be able to handle a 230 kg (500 lb) dropped from 5.2 m (17 ft).

It is also required to follow ROPS and FOPS standards if you are building your own equipment.

One advantage of a tractor over an ATV is that they can come with approved protective structures.

! Modification to your cab frame or ROPS can invalidate your warranty and the manufacturers liability for the protective structure. This includes any drilling or welding since it can weaken the structure. If you plan to drill the roof to attach angle irons or plywood, check first with the tractor dealer or manufacturer.

Other modifications:

1. Chains on tires — Increase traction
   (BUT can also cause rear roll overs on hills - take extra care)
2. Weight in front — Reduce risk of rear rollovers
3. Deflector bars or cables — Protect exhaust pipe and front of cab

Additional protection

1. Heavy duty forestry tires — Resist puncture
   (For forestry work should have 10 ply on whole tire, not just tread)
2. Oversize tires — Increase clearance
3. Valve stem protection
   (A piece of pipe can be welded around the stem)
4. Protective pan or skid plate under tractor
5. Radiator grill
6. Shield around Power Take Off (PTO)
7. Vertical bar window screens for side and rear windows.
8. Steel mesh screen for door and engine where visibility is not blocked.

Further reading on ATVs.....

An excellent handbook on ATV use in the woods and modifications is ***Using an All-Terrain Vehicle To Produce Long-Length Logs.***

Further reading on tractors.....

For tractor use in the woods and modifications see ***Using a Farm Tractor To Produce Long-Length Logs***.

For much more detail on tractor features, protection, safety, and attachments see: ***Equipping the Farm Tractor for Forest Operations***, FERIC Handbook #11.

For information on required equipment standards in Atlantic Canada, see ***The Forest Professional, Guidelines for the Stewards of tomorrow's forests*** Appendix A.

See **Appendix A**.

LESSON TWO QUIZ

(*Answers are on last page.)*

1. Which of the following contribute to a safer ATV when using it for harvesting:

a) liquid in the tires

b) liquid in the gas tank

c) liquid in the driver

2. Chains on the tires:

a) improve traction and braking

b) improve steering

c) improve clearance

3. ROPS stands for Roll On Protection Stick

_____ True

_____ False

4. Weight in front of the tractor reduces the risk of rear rollovers

_____ True

_____ False

5. Tractor protection includes:

a) valve stem well

b) pan under tractor

c) shield over the PTO

d) all of the above

LESSON THREE:
ATTACHMENTS FOR SKIDDING AND FORWARDING

This Lesson introduces you to some of the more common attachments for your ATV and tractor. This will help you chose an appropriate one for you based on your objectives from Lesson One.

A variety of larger, more expensive attachments are also available for large scale harvesting. This Lesson focuses on smaller, less expensive attachments.

Lesson Three also provides three case studies of woodlot owners for you to learn about the harvesting attachments they have built or modified.

SKIDDING ATTACHMENTS

Sulkies and sleds are typically used with an ATV though they can also be used with smaller tractors (20 HP) or horses. With tractors, make sure yours has enough horse power for the attachment you choose. Horse power comes in two classes - up to 30 HP and more powerful tractors. Attachments are not transferable between classes. Check with a dealer the get the specifics on the two classes.

All costs listed below are approximate. Maximum skidding and forwarding distances are noted. A chart comparing attachments is provided on Lesson Seven - Putting It All Together.

ATV Cable
Skidding distance Up to 30 m

If the brush is too dense or the site is wet or sensitive, you may not get up to the log in your ATV. If so, you can attach a cable and pull it out. Because of the short distance, it is not very efficient as your primary means of moving wood. But if you only have a few logs that you can't reach, it is effective and inexpensive.

You will need 30 m (100 ft) of braided cable. It can be stored on a reel that is attached on the back of the ATV for easier handling. Cable care and construction are explained more in the next Lesson.

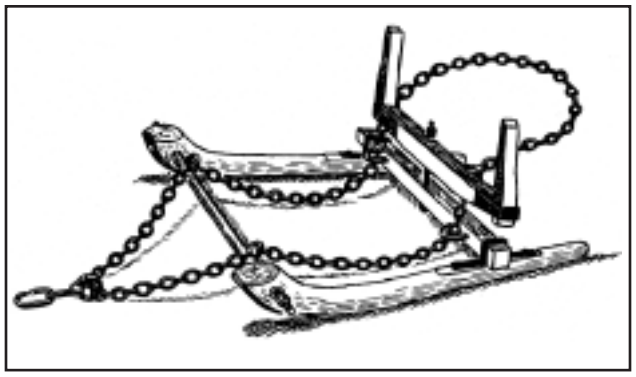
Cones, pans and grapples are used on the end of the cable to help skid the load. See Lesson Four - Accessories and other Equipment Options.

Example A

Joan has a small woodlot and wants to cut a few cords of firewood. She already owns an ATV and a small trailer that she uses in the garden and for cleaning up the yard. She doesn't want to spend a lot since her harvest is so small. She can cut what she needs from along her skid road and use a cable to skid it out. She can buck it roadside and load it easily by hand into the trailer. She decides to buy a cable, reel and a cone.

Homemade Sled
Skidding distance Up to 500 m

Sleds can be used to skid the wood out when you can reach the log in the woods or piled on a trail. You can build a simple sled with wood runners covered on the bottom with iron. It does require some manual lifting to get the log(s) onto the sled. A chain or cable runs through the loops and over the top of the load. This pulls the load down when you move forward. Specifications can be found on Page 87 of the Small Scale Woodlot Equipment binder. See Appendix A.

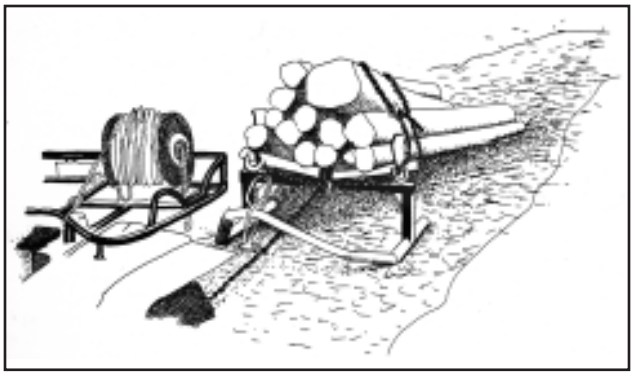


3.1 Home-made sled

Self-loading Sled
Skidding distance Up to 500 m

A self-loading sled is an inexpensive way to haul wood. It is set up like an upside down U with the log(s) attached behind. You only have to lift the logs a few inches. When the machine moves forward, the U falls flat lifting the log onto the sled.

Cost: $500



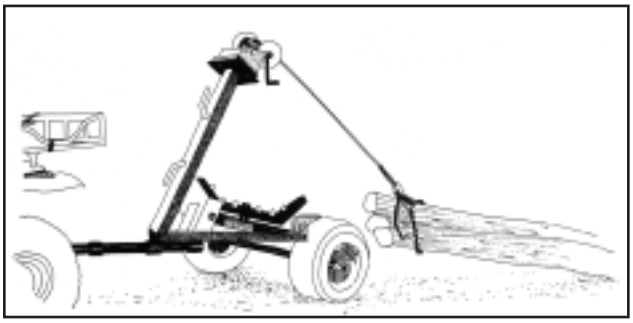
3.2 Self loading sled

Sulky and Log Arch
Skidding distance Up to 500 m

The sulky and log arch can be dual purpose - they can winch the log out to the trail a short distance (about 8 m or 30 ft) and also skid wood half a kilometer. These are sometimes called "mini skidders". A minimum winch capacity of 1,000 lbs is recommended.

A sulky consists of a cradle on a small, two-wheeled unit that can be pulled behind your machine. It can also have a winch and shaft. One end of the log (s) is winched into the cradle and the other end skids behind. It can be converted into a trailer for forwarding by attaching a pole to some rear wheels with a cradle. A jack or a manual winch may be used to lift the log into the cradle. Make sure to practice back safety. A self-loading model is also available. See Appendix B.

Cost : $800
Manual winch $ 80
Electric winch $500



3.3 ATV Sulky

Example B

Pierre has a small woodlot and cuts about 20 cords a year. He has cut out skid trails so he can get back to some sawlogs. The trails are too rough for a trailer. He decides to get a sulky. It can skid the logs out to the skid road. There he can attach wheels to the back of the load and forward the logs 1 km to his yard.

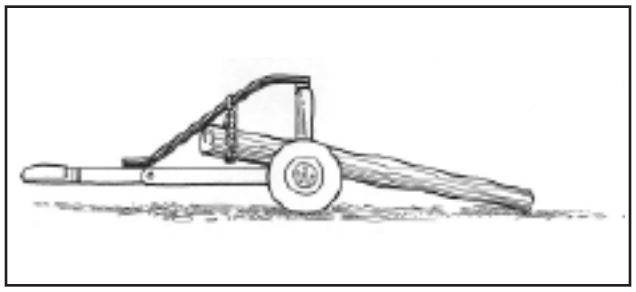
Log Arch

A log arch is a sulky where the load hangs inside an arch. This allows the load to swing making it easier for the wheels to go over obstacles. It can also be converted into a trailer for forwarding.

Self-loading log arch with chain

This arch has a sloped rod with a ring running on it. The first step is to position the arch over the logs. You choke two or three logs with a chain, fasten the chain to the hook on the ring, and as you move forward, the ring slides up the rod, lifting the ends of the logs off the ground.

Cost: $800



3.4 Self-loading log arch

Case Study One

Homemade Log Arch
The Berry family

The Berry family of Clementsport, Annapolis County have a 73 hectare (180 acre) woodlot that has been in the family for four generations. It is mixed spruce and hardwood. The family mainly cuts firewood and also a few logs " when we get the time" for lumber and for sale. Pulpwood "tops" are a by-product.

Third generation Rick and his son Bill also run a professional machine shop building, repairing and modifying equipment. In the 60s, Rick's father built a homemade skidder that the family still uses today - not something you see everyday! They use it in dry or winter conditions to haul tree length logs. Bill says, "We have a couple of old tractors but the skidder works so much better and is not really any bigger."

The family also uses a homemade log arch pulled by an ATV. This is a small unit on two wheels with a hand winch and 8 m (25 ft) of cable. It can haul a log 16 feet long that is 12 inches at the butt. The cable is attached to the log or logs and then winched to the log arch. The logs hang about 0.6 m (2 ft) off the ground.

Photo 3.1 Log Arch

"The log hangs ahead of centre of the wheels which allows the weight from the butt of the log to press down on the trailer hitch of the ATV which gains you traction on the ATV," says Bill.

"If we're picking out a few trees, we do it with the ATV and the log arch. It depends on what the conditions are and what mood we're in. If we have a spot where the trail is tight, we cut the logs to 16 feet or whatever." The hitch is made to swivel laterally so the arch can ride over rough spots and even roll over but not upset the ATV.

To find out more about the log arch, you can contact the Berry family at 902-638-8668 (machine shop).

WINCHES

Capstan winch

A capstan winch can be attached to the back of the tractor and run off the PTO shaft. A portable one is also available that can be secured to a tree.

This winch has no take-up reel and so you need to wrap the rope around the capstan (three times) which is constantly rotating when engaged. As you increase your pull on the end of the line, it tightens down on the rotating drum, and the pulling begins. A capstan winch on a tractor should have two stabilizer legs or a blade that can be lowered and raised.

Loading winch

A loading winch consists of a drum, a boom, two pulleys, and a cable. The winch can run off the PTO or a small hydraulic motor. It can be mounted on the tractor or the trailer. The cable runs out the end of the loading boom and the log is winched forward. Once the log reaches the trailer, it can be loaded using tongs on a chain on the end of the boom. Using a loading winch to skid logs is not as efficient as the skidding winch (see next) though it does allow you to forward the wood and move it further.

Example A

Klaus has a tractor and harvests about 20 cords per year on his small woodlot. He plans to cut more in the future so he will need a winch and a big trailer. He decides to buy a loading winch that can skid the wood out and also load the trailer. He plans to build a trailer from old parts.

Skidding Winch

Skidding distance	**Up to 200**
With a sulky	**Up to 500 m**

A skidding winch is the most widely used tractor-mounted harvesting attachment. It lets you winch logs to the tractor from about 30 m in the woods and is also useful for other tasks on the woodlot. The right one for you depends on the HP of your tractor.

The skidding winch is usually powered by the PTO and attached to the three point hitch on the back of the tractor. The three point hitch allows the tractor to raise and lower the winch for winching or skidding operations. If you buy a used one, make sure it has a safety cover for the PTO.

		Requires:	Pulls:
Small skidding winch	**$2,000**	**20 - 30 HP**	**6,000 lb**
Medium skidding winch	**$2,400 to $3,600**	**40 - 80 HP**	**8,000 lb**
Large skidding winch	**$4,800 to $5,400**	**75 - 100 HP**	**11,000 lb**

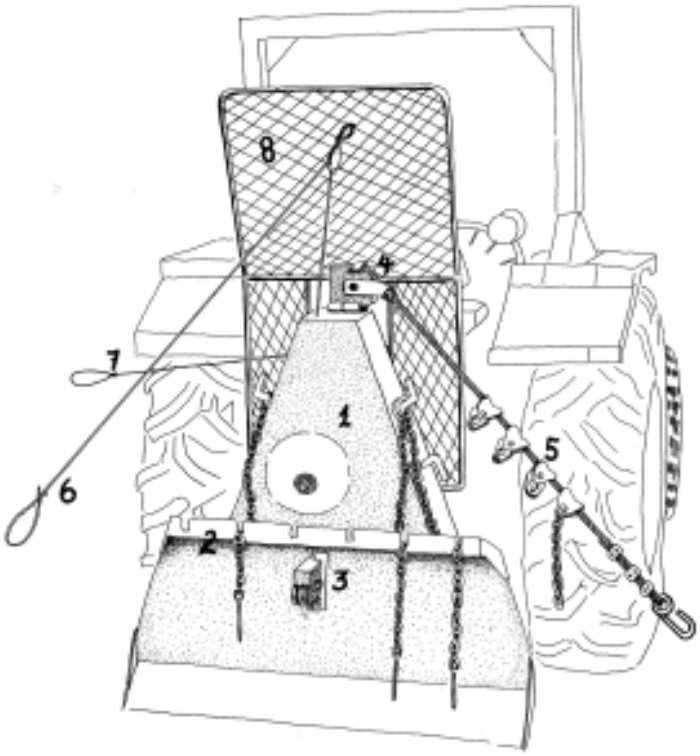


Fig 3.5 Parts of a skidding winch

1. Main Frame
2. Butt Plate
3. Lower Pulley
4.Upper Pulley
5. Cable with hook and sliders
6. Clutch Cord
7. Brake Cord
8. Protective Grill

Several manufactures now make farm skidding winches that make use of the increasing availability of auxiliary hydraulic ports. While there are advantages to both ways of powering the winch, the hydraulic system is considered a big safety gain since there are dangers associated with the PTO system.

When buying a winch , make sure you understand what it includes. Some do not come with cables and sliders. Others may be just the actual winch and not the blade or butt plate. Stabilizing legs may be a better choice if you also want to attach a trailer at the same time.

Use the lower pulley when going on a slope or bumpy trails. The lower weight will help prevent rear roll over. It is also useful for skidding large trees.

Using the upper pulley gets the logs higher off the ground but the weight is also higher making it easier to tip over backwards.

The addition of a sulky makes a good working pair. With the load raised up, the tractor comes up behind the sulky and then in front so the load slides on the cradle. A sulky is easy to use, gets the load off the ground and increases the distance from 200m to 500m.

Fig 3.6 Skidding winch on a tractor.

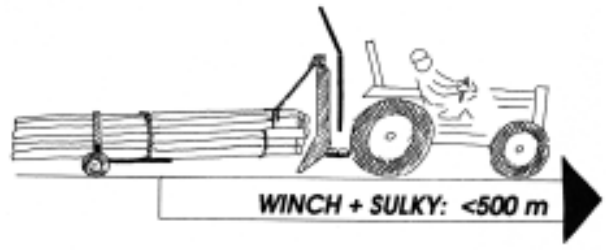


Fig 3.7 Skidding winch and sulky on a tractor.

Case Study Two

Homemade Winch and Trailer

Ivan Bain

Ivan Bain has a 100 hectare (246 acre) woodlot in North Range, Digby County that he has owned since 1967 and has been in the family since the fifties. The woodlot is mixedwood and he cuts sawlogs, studwood, firewood and pulpwood mostly for sale. He says he cuts about 200 tonnes of sawlogs per year and 25 cords of firewood. He gets his wood from thinning with no clearcuts.

Ivan uses his trusty 40 HP 1965 International tractor along with a homemade winch and power trailer. "I had access to a lathe so I built everything on it". He is not afraid to experiment and has made numerous changes to his equipment over the years. With the addition of a grapple loader, he created an all-in-one system that winches, loads and forwards.

One challenge he had was to be able to power the winch and trailer at the same time. "The first winch I built went over the PTO so I could not hook up the power trailer. So I had to design another one..... I pressed a 11 tooth sprocket, #50 chain on the PTO shaft ahead of where the PTO goes on and that what's runs my winch."

The 3/8" winch cable runs up a short mast to a pulley which can turn 360 degrees like a weather vane to winch logs along side of the trailer. The cable is 50 m long (150 feet) with a grapple on the end and can pull 1800 kg (4000 lbs).

Note: A "grapple" (often called skidding tongs or a skidding grapple) is a small log grabber at the end of a cable that is manually attached to a log. A "grapple loader" is a large, hydraulically-powered log grabber at the end of an articulating arm.

Photo 3.2 Homemade winch (note mast, pulley and grapple)

Ivan also built a power trailer from an International truck frame that can haul about two cords. He added a grapple loader and made the tongue longer. The hydraulic hoses come in through the tongue which protects them. He raised the frame after he added the new loader and extended the rear end to haul longer 16 foot logs

Photo 3.3 Homemade trailer with grapple loader

Ivan now uses a commercially built Patu grapple loader which he says was a good investment for him. To reach logs behind, he can put the winch cable out through a split block pulley on the end of the grapple loader. "I just put the pulley on the grapple on my loader and I can hold the loader (arm) out and run the cable through that and haul the tree right in beside me." The grapple loader then loads the log onto the trailer.

Before the Patu, he used another hydraulic system that he rigged up with a boom, cable and grapple. "The old boom used to swing out so I could lengthen or shorten it. I loaded a lot of 4 and 8 foot firewood with that."

He says the system travels well in the woods. "It will go through two feet of snow. I use forestry chains on the tractor and ordinary cross chains on the trailer. I can back it up anywhere - I just put the transmission in
reverse and it will back uphill. When you have power in both of sets of wheels, you can back up pretty good."

To find out more about this homemade winch and trailer, you can contact Ivan at 902-245-2356. E-mail: wellness1@eastlink.ca

FORWARDING WITH TRAILERS
Forwarding distance Up to 1 km

Many different trailer styles are available to buy or build. Be sure to pick one that is not too large and can be pulled safely by your ATV or tractor when fully loaded.

The trailer usually has removable stakes to keep the load in. It can be loaded by hand or with a manual, electric or hydraulic winch and a boom. Attachments on or between the stakes help you to pivot and more easily load the logs.

When forwarding with a trailer, the logs are completely off the ground. This means less strain on your machine so you can have heavier loads and forward further with a trailer than by skidding. It also causes less environmental impact.

! Most ATV brakes are designed for light duty cycling. Forwarding wood on a loaded trailer in a downhill direction can cause premature brake wear and failure and can be dangerous

See Lesson Six for tips on safe forwarding with an ATV.

Fig 3.8 ATV trailers should not exceed a maximum load of 600 dg (1,300 lb) and maybe less on smaller ATVs.

Trailer options

1. Wide high pressure tires
2. Telescoping trailer bar and protective grill
3. Trailer brakes
4. Single beam fame or rectangular frame
5. Two tires or four tires
6. Fixed wheels or bogie wheels (on four tire trailers only)
7. Powered or unpowered (with tractors)

Examples of powered and unpowered trailers:

1. One common trailer in Nova Scotia is an unpowered, single beam, bogie-wheel trailer. With bogie-wheel, the two tires on each side are attached to a beam that allows the tires to move up and down over bumps separately from the frame.

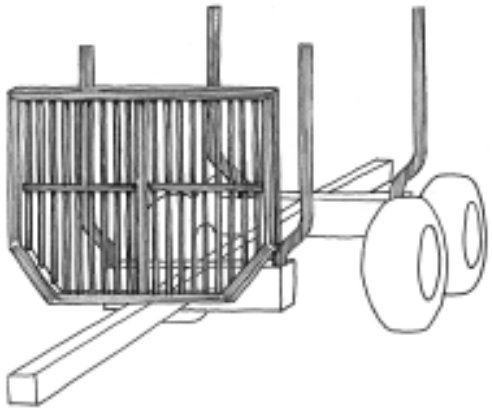


Fig 3.9 Unpowered single-beam bogie-wheeled trailer

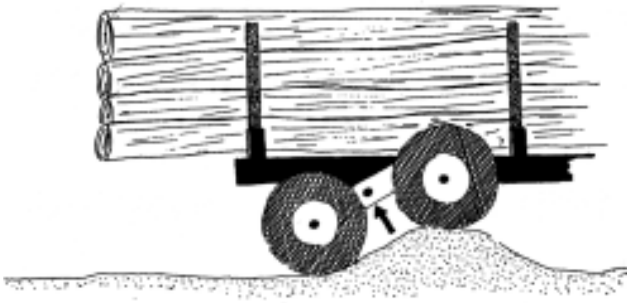


Fig 3.10 How bogie wheels work

2. A common powered trailer is one built from an old truck. You can use the axle, tires, frame and transmission. The tractor PTO connects to the old truck drive shaft.

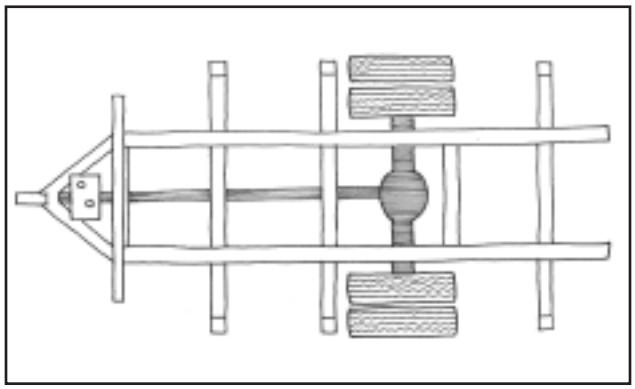


Fig 3.11 Powered trailer, Note drive shaft

Ground Speed PTO

Some tractors have a PTO speed that varies with the tractor speed on the ground rather than the RPMs. This is called Ground Speed PTO and it is very useful for getting around in the woods. It will match the speed of the trailer to the speed of your tractor. You can then stop or go forward or backward in various gears with a trailer without disengaging the PTO. All powered wheels can be braked which is helpful for stopping on hills.

Commercially built trailers

$3,600 to $7,200

Depending on load capacity, wheel type and if it is powered.

Trailer built from an old truck

$1,200 to $6,000

Trailer Hitches

Rotating Hitch

This kind of hitch as mentioned in the Berry story means the machine and trailer (or other attachment) can move separately. If the trailer upsets, the machine does not go over too. Also the drawbar and hitch will not be bent. A rotating hitch is a wise idea - be sure to include it if you are building a homemade trailer.

ATV Garp Hitch

This a specialty hitch for ATVs that places more load on the front for increased traction and safety reducing the probability that the ATV will flip back. It consists of a fixed frame that attaches under the entire ATV and a mobile section and a swivelling hitch behind for the trailer, log arch or sulky. It is described on Page13 of the Small Scale Woodlot Equipment binder. See Appendix A.

Tractor hitches

The standard tractor has a long drawbar (or tongue) that attaches to the trailer's drawbar. A long tractor drawbar does not work very well for doing woods work.

It can go down to hit stumps or up to hit the PTO shaft. Shorten the drawbar to help prevent this.

Here in Nova Scotia, many tractor owners have put the drawbar above the PTO. The drawbar and the PTO shaft move up and down together. However, there is more weight on the back of the tractor and if it becomes stuck, it increases the risk of a rear roll over. For this reason you should use a 4WD tractor with extra weight on the front and operate on flat ground with this setup.

The hitch itself can be on the tractor drawbar or the trailer drawbar. With standard tractors, attachments are hitched with a pin that goes though a clevis at the end of the drawbar. This kind of hitch gets worn out with the uneven ground in the woods. A pintle hook hitch allows for more vertical movement. (See also swing tongue hitch in Case Study Three below).

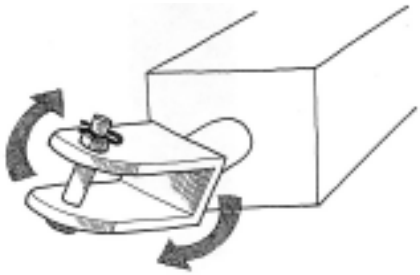


Fig 3.12 Standard clevis and pin on a rotating hitch

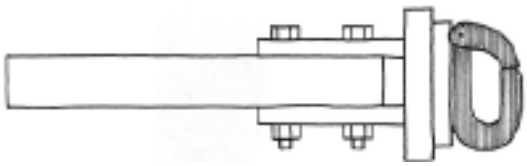


Fig 3.13 Pintle hook and ring

Case Study Three

Convertible Trailer

George Chisholm

George Chisholm is a forestry contractor in Bear River, Digby County. He does a lot of his work on his 244 hectare (600 acre) woodlot that was originally 162 hectare (400 acres) owned by his father and grandfather. He cuts sawlogs, studwood, and a little pulpwood. He did a lot of thinning to start but now does more small clearcuts.

For a tractor, George has a 70 HP 4WD with a covered cab. It has Ground Speed PTO which lets him back up without changing the trailer transmission and operate in more

gears. He built his trailer from a bus frame and used the wheels off a 3-ton truck. It can carry 1.5 to 2 cord.

At first George used the trailer with a grapple loader and a four person crew. He has a seat on the trailer facing back so he can operate the grapple loader comfortably.

Photo 3.4 Tractor and convertible trailer

He later added a winch and a two-grip processor that operate from the trailer along with the grapple loader. The winch lets George work in steep and swampy areas. The grapple loader places the log in the processor which cuts it into the desired length. (unlikely to be used in a small scale operation). George now has a 2-3 person crew.

The winch, processor and grapple all work together as needed. The trailer drive shaft powers the winch via a chain and sprocket. A shaft from the winch drives the processor hydraulic pump. The grapple loader works off the tractor hydraulics.

George has designed his system so that the winch and processor are mounted on a sub frame on the trailer for cutting operations. Once he has many piles ready for pick up, he removes the sub frame, and the trailer is fitted with a rack and used for forwarding.

His trailer also has a swing tongue type hitch which uses hydraulics to push the trailer
right to left to follow the tractor tire. George says this is useful in tight areas and for swinging out around obstacles. It also means he can keep his roads narrower.
George can be reached at 902-467-3096 to find out more about his convertible trailer.

OTHER TRACTOR ATTACHMENTS

All of the attachments below are connected to the tractor via the three point hitch which is on the back of the tractor and used to raise and lower attachments.

Tractor Skidding Bar and Butt Plate

Skidding distance Up to 100 m

A skidding bar is a heavy metal bar with slots along the top attached to the back of the tractor by the two draft arms of the three point hitch. A butt plate is similar but higher. They are suitable for harvesting small amounts of wood. The main advantage of these attachments is the low cost.

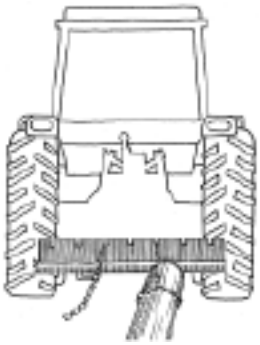


Fig 3.14 Skidding bar

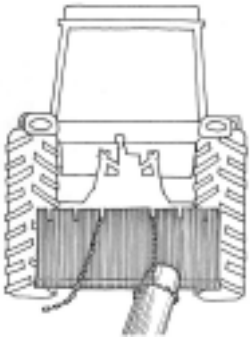


Fig 3.15 Butt plate

You need to cut a small extraction trail up to the logs you want to skid out. The chain is attached to the log, put through the slot and then the log is lifted up. This keeps it cleaner than pulling it along the ground.

! There is a significant risk of a back flip if the log catches when the tractor is moving.

		Useful for:	Requires:
Skid Bar	$200	10 to 15 cords per year	30 to 50 HP tractor
Butt Plate	$400	(35 - 55 m^3)	

Example B

Bill has an old tractor and a woodlot with lots of trails. He wants to cut 10 cords a year for firewood for his new wood furnace and a few to sell. He doesn't want to spend much. A skidding bar only costs $200 but he will have to cut trails up to the trees he plans to cut or cut close to existing trails. With a skidding bar, he can move the wood up to 100 m. From there, the logs will be chained onto two rear wheels and forwarded out.

Tractor Back Rack
Forwarding distance Up to 150 m

A back rack is useful for carrying up to eight foot lengths of wood though lengths shorter than the tractor width handle easier. The logs are piled in the rack manually and a chain can be used to secure them. The load is then lifted off the ground but not any higher than needed to clear obstacles.

The back rack is inexpensive and useful for small amounts of wood. It can also be used to carry other materials around the woodlot. Extra weight is needed on the front of smaller 2WD tractors to offset the weight on the back.

Again be aware of the potential for back flipping the tractor when the rear axle loads are increased .

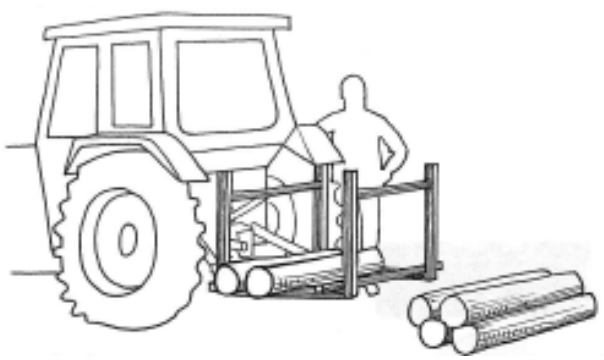


Fig 3.16 Back rack

Tractor Fork Lift
Forwarding distance Up to 150 m

A fork lift can be used for eight foot lengths. The logs are stacked on skids. The forks slip under the pile which is secured by a chain and then lifted. The load can be easily dropped at the pick up site. Because the load is wide, the fork lift works best on flat terrain so it does not get unbalanced.

The back rack and the fork lift can work well together. A set of forks can be installed on the front to carry wood and help balance the weight on the back.

		Useful for:	Requires:
Back Rack	$300 to $400	17 cords per year (60 m^3)	Tractor with front weights And/Or 4WD
Fork Lift	$500 to $1,000	15 to 30 cords per year (55 - 110 m^3)	

Further reading on attachments…

Specific models of ATV and tractor attachments and company contacts are provided in ***Small Scale Woodlot Equipment***, a binder produced by the Maritime Woodlot Extension Committee.

For more detail on tractor hitches see: ***Equipping the Farm Tractor for Forest Operations***, FERIC Handbook #11.

A useful guide to tractor attachments is ***Forestry Implements for the Farm Tractor***, Supplement to FERIC Handbook #11 above.

See Appendix A.

LESSON THREE QUIZ

(*Answers are on last page.)*

1. An sulky does NOT have:

a) a shaft

b) a cradle

c) a winch

d) a rider

2. A sled can handle a heavier load than a trailer.

_____ True

_____ False

3. With some harvesting attachments, you need to get right up to the log.

_____ True

_____ False

4. Winches can be:

a) PTO driven

b) Electric

c) Hydraulic

d) Manual

e) Gas engine powered

f) Any of the above

5. The maximum recommended length of a winching cable is :

a) 10 m

b) 30 m

c) 60 m

6. A tractor skidding winch is run by:

a) skidding the tractor

b) the tractor PTO or hydraulics

c) spinning the tires

7. The only way to load a trailer is by hand.

_____ True

_____ False

8. Trailers for tractors can:

a) be powered or unpowered

b) have two or four tires

c) have a single beam or box frame

d) have fixed or boogie tires

e) all of the above

9. A rotating hitch is a good idea because:

a) it lets the trailer rotate separately from the tractor or ATV

b) the trailer can roll over and not take the tractor or ATV with it

c) the drawbar and hitch will not be bent

d) all of the above

10. A skid bar is useful for production of 100 cords (360 m^3) per year.

_____ True

_____ False

LESSON FOUR:
ACCESSORIES AND OTHER EQUIPMENT OPTIONS

A variety of accessories are used along with the attachments covered in the last lesson. They are used to fell the log, move the logs into position and attach the log to the cable. They allow the log to slide easier and skid forward at an angle if necessary. These items are described below in the order that you would use them when felling and skidding the tree.

Lesson Four also looks briefly at options other than an ATV or tractor as your main machine. Some of these options are not commonly used but may suit your situation.

ACCESSORIES

Chain Saws

For homeowner use: Small saw
40 cc and under
For woodlot work: Intermediate saw
40 to 60 cc

- Get one that is big enough for the tree size and cut size you plan to do.
- Newer ones have fewer emissions.
- Talk to chainsaw owners as well as a few dealers.
- If possible, take a saw home for the day to try out.
- Choose a reputable dealer who is not too far away when you need repairs.
- Check the Internet for chainsaw options and to chat with other users.
- Complete a training course before you start to cut.

To sum up, do your research so you don't buy a saw that is not up to the job. To learn more about chain saws and felling tools, read **Module Six - Chain Saw Use and Safety.**

Felling levers

First notch the tree low to the ground on the side you want it to fall. Then do a cut on the other side. You can insert **a felling lever** there part way through the cut. This keeps the saw from getting jammed and helps you push the tree over. The lever can also be used to roll trees that hang up when skidding.

Another innovative tool is a **felling jack** made with a car jack in the middle of two square tubes and a wedge on either end.

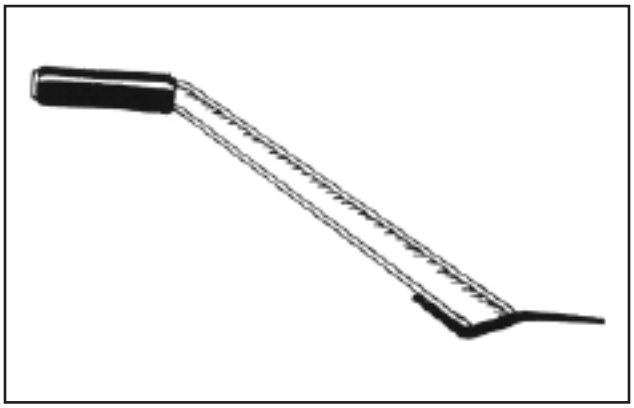


Fig 4.1 Felling lever

See **Module Six, Chain Saw Use and Safety** which includes a lesson on safe felling and felling tools.

Cones, pans and grapples

Using these accessories allows the log to slide easier and reduces hang-ups on obstacles while winching and pulling. Which one you use depends on the size of the logs and how many logs you are winching at once. If you are winching one log, a grapple can be used. For one or more, a cone can be used. A pan can be used for two or more small logs. If using a cone or a pan, pre-bunch the logs for pick up and use a choker to hold the log(s) in place.

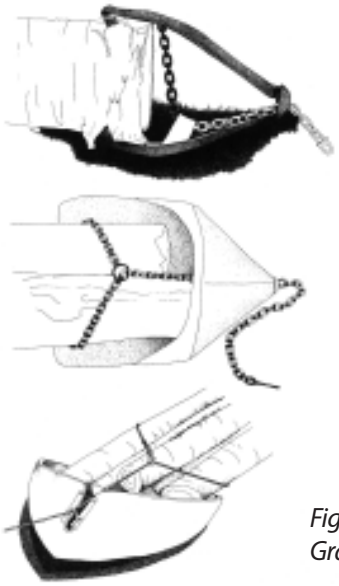


Fig 4.2
Grapple, cone and pan

Cables (Steel verus Synthetic)

Steel cable has been a standard for many years because it is strong, durable and low cost. A synthetic cable Kevlar® was also used. More recently a synthetic fibre called Spectra®, already common in other industries, is now being used in forestry.

Spectra® cable allows for longer winching distances which means less trails and less impact on the soil. It is eight times lighter than steel so there is less work for the operator to haul out and handle. It is also easier on the hands than steel. (Note: This information refers to 12- strand double-braided hollow core Spectra®)

The cable should be pre-stretched by winching a few light loads with no sudden jolts. Inspect the cable regularly for abrasion and cutting. Reverse the cable from time to time to ensure even wearing. Also recoating the cable helps it resist dirt.

See the FERIC guide, **Spectra Rope for Skidder Mainlines.**

Chokers

If using a tractor and /or a powered winch, chokers (made of chains or cables) are used to attach the logs to the mainline. Chokers are useful for gathering logs that are spread out. They are at least 2m (6 ft) long with a 20cm (8 in) rod on one end and a ring or hook on the other. The rod is used like a needle to pass the choker under the log and back through the ring. See "How to use a choker" in the next lesson on winching.

Snatch blocks

Snatch blocks (or pulleys) are very useful for winching around obstacles and at an angle. (see Lesson Five under Winching Techniques). Some are manual release and other more expensive ones are self release. They are attached to the tree with a chain or strap (use a strap if saving the tree since a chain will damage it).

Self releasing snatch blocks drop the load once it reaches the tree to which the block is attached. For a manual one, you use a pin. These blocks can also be used when moving a stand-alone winch to where you want it or freeing a hung-up log that you are skidding.

Tongs and hooks

These are used to help lift the log into position for skidding, forwarding or if it gets stuck. Tongs have two points and allow you to grab and lift a log with one hand. A hook has one point and is jabbed into the log to lift it. These tools really save your back.

OTHER EQUIPMENT OPTIONS

Stand-alone winches

Yankee Yarder
Skidding Distance - Up to 75 m

The Yankee Yarder is a full time winching platform on a sled. It is designed to be a self-propelling unit. The cable is spooled off the winch drum and pulled out to where you want to work from and attached to a tree. You then start the winch and the Yankee Yarder pulls itself to that tree. The process is repeated until you get to where you want to be. It can also be hauled by an ATV, in the back of a truck, pulled on a trailer hitch or moved around manually like a wheel barrow. It runs off a small gas engine (5- 10 HP).

Cost: $1,500

Chain saw winch

The chain saw winch is a smaller and lighter than the Yankee Yarder and runs off a chainsaw engine. It is generally meant for emergency or part time use. Models vary in size and pulling capacities from 900 kg (1,980 lbs) up to 3600 kg (8,000).

Cost $1,200

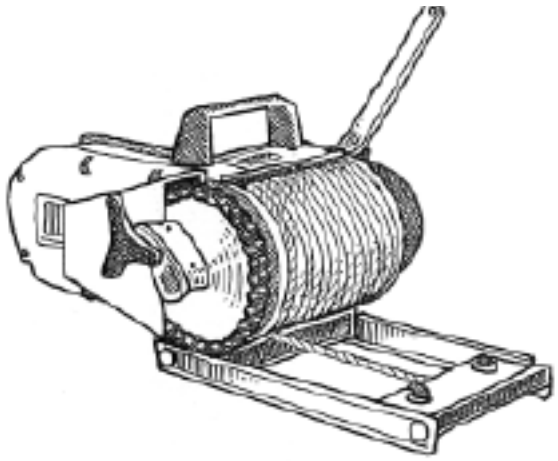


Fig 4.3 Chainsaw winch

These winches usually need snatch blocks for getting around trees and winching at an angle. See Appendix B for Web sites.

Mini-Skidders

A mini-skidder, also called a walk behind, is a tracked machine that the operator walks in front of. It is gas powered with a boom, winch and cradle and can pull a small trailer. These work well but are slow and relatively expensive at $10,000. They are not very versatile so are not common but may be a solution if you do not own or need a tractor or ATV and want the winching/ hauling capability. See Appendix B for Web site.

Skidders

If you are harvesting or plan to harvest very large amounts of wood (100 plus cords/362.5 m^3) per year), you may decide to invest in a skidder. This is a powerful, tractor-like machine that comes is various sizes and is designed specifically for skidding wood and so is not as versatile as an ATV or tractor. It is much more expensive than a tractor but it can manoeuver easily in open conditions and move more wood in a given time.

A skidder may be a cost-effective option in that it is purpose built and does not require additional expenses to provide the necessary protective structures to operator and machine.

Fig 4.4 Skidder

Off-road Utility Vehicle

An off-road utility vehicle (UV) is similar to an ATV but with some important differences. It is wider and longer and two people can sit side by side. This makes it more stable in the woods but most models are not as maneuverable. It can also be more powerful than most ATVs . They can be a 2x4, a 4x 4, or a 6 x6 wheeler.

The UV has a larger storage area in the back called a cargo bed where a small amount of short wood can be piled. It usually has ROPS. Some can be outfitted with a track kit as can ATVs (like a snowmobile) that helps in deep snow and mud. It costs more than an ATV but the extra versatility may make the investment worthwhile depending on your needs.

Snowmobile

A snowmobile can be used for skidding or forwarding wood. For woods work, you want a utility snowmobile not one designed for touring on groomed trails. The track on the machine should be at least .45 m (16 in) wide, and a long track of 3.8 m (11.3 ft) is preferred to distribute the weight.

An engine size of 500-550 cc is recommended. Also look for one with low gearing. A snowmobile with an air cooled engine is lighter than a liquid cooled engine and so less likely to get stuck. Another feature to look for is storage under the seat. Utility snowmobiles start at around $8,000.

Longer, wider, more powerful machines can also be used that have better traction, buoyancy and high and low gears. The disadvantages are increased cost (about $11,000) and weight. Also the increased length means that it works better in open situations.

Horses and Oxen

Some woodlot owners in Nova Scotia use horses or oxen for small scale harvesting.
This is done mostly in winter. It requires operator skill and knowledge as well as daily care and attention to the animals. In a selection cut, one horse logger says it is twice as fast as using a tractor and winch, and more profitable in some situations. He also says it can be much less damaging to the forest. It is not efficient for a high production clearcut situation.

Most attachments suitable for ATVs or small tractors can be used with horses or oxen. Cables can be used to skid the wood along with sleds, sulkies, cones, pans and grapples. Loaded trailers can be pulled by the horses or oxen.

Truck Tractor

A truck tractor is an old truck converted into a tractor-like machine for skidding wood. People who are mechanically talented and have access to a garage may want to consider this option. It requires some modification to the body and time to do the work but it is cheaper than a tractor.

Some keys to good truck tractors:

- High ground clearance (more than nine inches)
- Good wheel contact based on suspension travel
- High approach and departure angles
- Low gearing
- 4 WD and/or positive traction rear end

Fig 4.5 A truck tractor has high approach and departure angles.

Case Study Three

Custom Built Truck Tractor Russ Cushing

Russ Cushing believes in truck power. He says that trucks get used to drive to the store when they have enough power for hauling logs out of the woods. So when he needed to harvest wood, he modified a old truck into a truck tractor. By buying old parts and doing it himself, it was much cheaper than a buying a tractor. And he is still using it 25 years later.

Russ has a long, narrow 17 hectare (40 acres) woodlot with white spruce and mixed wood in Plympton, Digby County. He cuts firewood and sawlogs for his own use and "pulls out the trash to encourage the woodland". He now cuts only about four cords a year for firewood.

Russ says the truck is a handy vehicle for low impact, small scale selective cutting. "I can go in and cut an individual tree I want for a sawlog." The woodlot has a road up the middle of it which means he can reach almost any tree.

He began to build his truck tractor in 1981 when ATVs were not readily available . "The idea is you get an old four-wheel drive truck that's all rusted, take the cab and the box off of it, and then you put a real skinny cab on it like the body off a foreign car." This allows the door to open easily in narrow trails over the front wheels. He adds that if you use a small extended cab, you can have room for your chain saw and other tools.

Russ shortened a Chevy half ton 4 x 4 and added an Austin mini cab. Besides the usual parts (gas tank, radiator, throttle, cable clutch and steering), he also added a winch and a raisable boom that can telescope.

Photo 4.1 Homemade truck tractor

The winch has four speeds and reverse and a 80 foot cable with a 60 foot booster cable. It is mounted inside the frame over the rear drive shaft The winch is driven by the PTO attached to the transfer case and is used in the neutral position.

The boom can be raised with the winch cable and set at different heights using notches on the arch. It is used for hauling bigger logs and raises the log up higher than the frame. The boom is not used for loading. Russ loads his trailer by hand with smaller logs or chunked up firewood.

Photo 4.2 The winch cable can lift the boom up and down

The truck has no brakes since his land is fairly flat but the gears can be used to slow down or he can cut the engine with a switch on the dash. He has big tires for better clearance. For a demonstration, Russ hooked up the 15 inch butt end of an unlimbed pasture spruce on rough wet ground. The log bounced easily up and forward as the truck took off through the woods. "Shows you what a regular truck can do" says Russ.

Russ Cushing can be contacted at 902-837-5936 for more information on his truck tractor.

Further reading on accessories and other equipment.....

The Forest Professional, Guidelines for the Stewards of tomorrow's forests (2001)
has a section on Operating Chain Saw Use and Correct Logging Procedures including felling.

For using cables, chokers, snatch blocks, grapples, cones and pans see ***Using a Farm Tractor To Produce Long-Length Logs or Using an All-Terrain Vehicle To Produce Long-Length Logs***.

FERIC has produced a guide called ***Spectra Rope for Skidder Mainlines*** that also has information on splicing and attaching the cable.

For more information on skidders, UVs, stand-alone winches and felling tools refer to ***Small Scale Woodlot Equipment***, a binder produced by the Maritime Woodlot Extension Committee.

See Appendix A and B.

LESSON FOUR QUIZ

(*Answers are on last page.)*

1. A felling lever is used to:

a) Prevent saw jam

b) Push the tree over

c) Roll trees that hang up

d) All of the above

2. A grapple can be used to skid three logs at once.

_____ True

_____ False

3. The synthetic cable Spectra® is:

a) heavier than steel cable

b) lighter than steel cable

c) the same weight as steel cable

4. A choker should be 2m (6 ft) long.

_____ True

_____ False

5. A stand-alone winch is powered by

a) the tractor

b) a gas engine

c) an ATV

LESSON FIVE: WINCHING

Winching is done when your machine cannot get close to your cut tree. You get the log to the trail by winching it out with a cable. The tractor or other machine remains on the skid trail. You may find that you don't need a winch if you can get up to most of your logs. Pulling logs with a cable (and pulley if needed) and then skidding with a sulky for example may work for you.

WHEN TO WINCH

With an ATV

Since an ATV is small and maneuverable, you may be able to reach the log to skid it most of the time. However you may not be able to if the terrain is rough, the brush is too thick or you want to protect the new growth. In that case, you can 1) pull the log out with a cable or 2) winch it out with an electric or hand winch.

With a tractor

A tractor is less likely to be able to get to the log because of its size and handling features like ability to turn in the woods. Also in some stand conditions, it can cause damage to the new growth. For these reasons, a tractor should stay on well-marked trails.

WINCHING EQUIPMENT

On the ATV

The winch on an ATV is likely to be a hand or electrically powered winch on a log arch or sulky as discussed in Lesson Three.
The cable length is about 10 m. (30 ft)

On the tractor

A variety of winching attachments are available for tractors such as the a skidding winch, and the capstan winch described in Lesson Three.

Winching attachments on the tractor are generally run off the PTO shaft however there is a steadily increasing number of models that use a tractors hydraulics. The cable is usually 20-30 metres long, though longer reach cables can also be installed.

How to use a choker

Attach the furthest log first and work your way back to the tractor. When the winch starts, it pulls the furthest one first and then the others choke up along the mainline.

Wrap each choker about 40 cm (16 in) from the end of a log. If attaching to the top end, leave stubs to prevent it from sliding off. After wrapping the log, the choker goes through a slider on the mainline.

For the furthest log or logs, attach the hook on the end of the mainline to a special chain on the first slider (no choker). For the rest, thread the choker rod through the slider on the mainline leaving about 20 cm (8 in) between the ring and log.

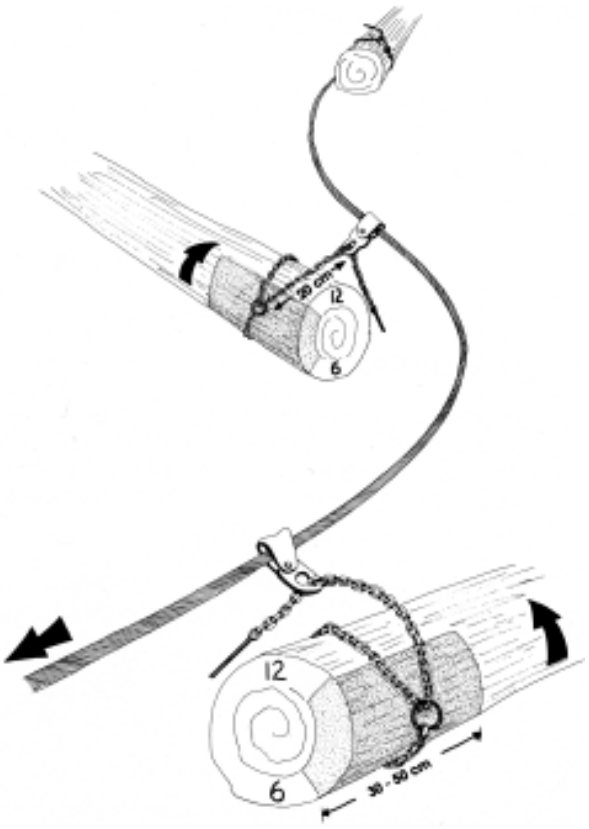


Fig 5.1 How to attach logs on a cable

When wrapping the choker around the log, make sure the ring is on the opposite side from the mainline. This tightens the choker against the log and rolls the log toward the mainline.

Example A

Pauline and Bill have a large tractor and plan to harvest 80 cords of wood per year mostly for sale. They have a good trail network and a D class road that allows a forwarder to collect the wood. They decide to invest in a medium size skidding winch. They can use chokers to pull out several logs at once and then skid them 200 m to where they are piled.

HOW TO WINCH

Trail layout

Before cutting, plan your layout. Extraction trails are not allowed within 7 m (22 ft) of a stream according to **Wildlife Habitat and Watercourse Protection Regulations** (2002). It is important to check current harvesting regulations. More detail on trail layout and landings is available in **Module 11 - Roads and Trails, Planning it Right from the Start**.

A well-planned layout ensures that your winch line can reach all the areas you are harvesting. Areas where you plan on harvesting should not be too steep or too wet. Winching allows you to move logs from areas that may be damaged by equipment such as tractors or ATVs.

You can increase production and improve safety by leveling off bumps, cutting stumps low, and using a dozer to scruff the top of main trails. To reduce tractor roll over, do not put trails across slopes, or up slopes more than 35 degrees.

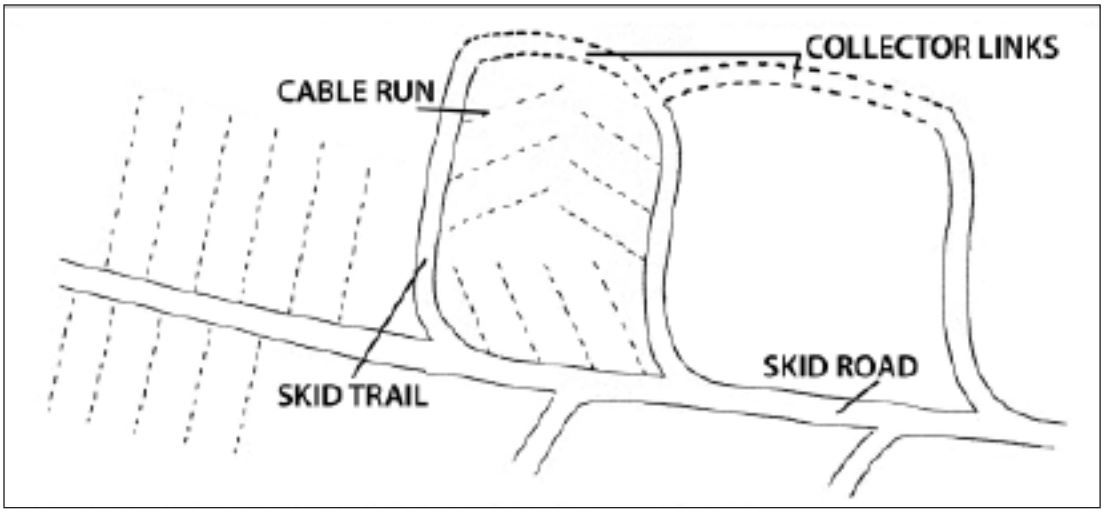


Fig 5.2 Skid trail and skid road system

Cable run

The trees are cut along this run. It is best for the runs to be at a diagonal to the trail.

Skid trail

The tractor remains on the skid trail when winching. Make your skid trails are 40 to 60 meters apart. This is because the cable can reach in for half of that (30 metres) from each side. The logs may be piled here or skidded out to the skid road.

Collector link

A tractor may not be able to turn around on a skid trail. The link lets the tractor go around the link and get in position to winch out from the cable run. It also lets a trailer be pulled around to collect logs piled on the skid trail if the trail is level enough.

Skid road

The skid trails feed onto the skid road. Logs are piled at landings on the skid road for later pickup or forwarded out by trailer along this road. Note that the cable runs may also exit onto a skid road. Plan landings so they are not more than the maximum skidding or forwarding distance.

How to fell wood for easy winching

Before you start cutting in a certain spot, take some time to figure out where you are going to fell each tree. You want to avoid having to skid over any major obstacles like stumps or rocks.

Fell the trees so the butt end or the top end of the cut log is pointing toward the cable run. This means less turning of the log and less damage to new growth. Drop the top end toward the run when the trees are past the end of the run or off to the side. This lessens the winching distance.

It's also better to winch from the top if there is a lot of brush or obstacles or if you have a large tree. The top end will lift easier because its smaller. You may need to double wrap the choker chain so it doesn't slip off.

Sequence

Work from the back out. This way the brush is behind you and you are not winching through it. You can also use trees that will be cut for bumper trees to protect crop trees.

Winching techniques

In a straight line

Park the tractor on the skid road or trail and lower the three point hitch. Put the tractor in neutral, put on the parking brake, lower the stabilizing legs, and engage the PTO. Pull out the cable to where the log or logs are. Attach the grapple or chain on the end of the cable to the log.

! The angle between the cable and the tractor should not be more than 30 degrees.

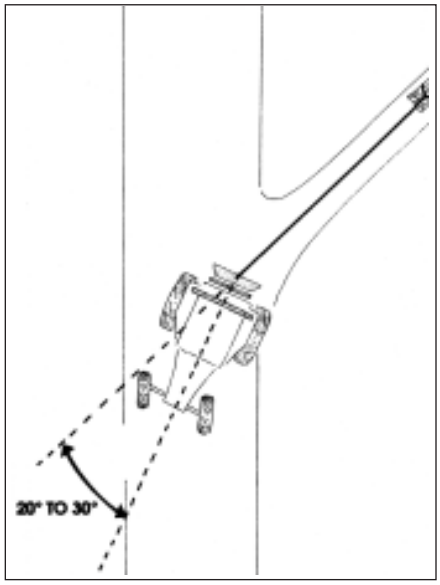


Fig 5.3 Safe skidding angle

It does not take much to pull over a tractor. If possible, watch someone who has experience winching to learn how to do it safely.

In most cases, the operator stands off to the side of the tractor to manually control the winch. A remote radio-controlled unit can also be used though it is not common. Stand beside the tractor and keep an eye on the log to better control how it moves. It is also a safer place to be in case the cable snaps.

At an angle

Sometimes the log cannot be winched in a straight line. The cable run may not be at a suitable angle. Or the skid trail may be too narrow for the tractor to turn onto with a load.

In this case, a snatch block attached to a tree on the skid trail can be a great help. Position it opposite the cable run. The tractor is parked on the skid trail and the cable is inserted into the pulley and then to the log.

The winch is started and when the log reaches the snatch block, it is released. Further winching pulls the log into line with the tractor. It can then be skidded to the landing or other staging area.

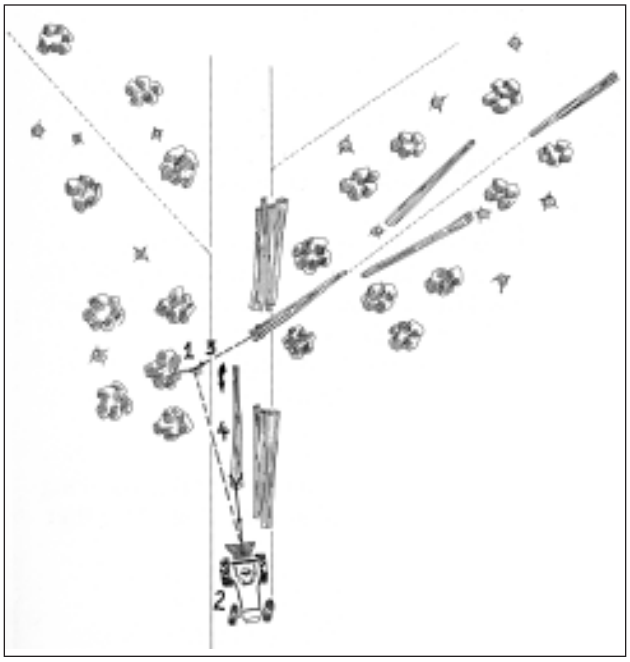


Fig 5.4 Steps in winching with a pulley

This snatch block method can also be used when there is no winch. The tractor or ATV moves forward to pull the log out instead of winching it.

Protection of remaining trees

Remaining trees can be damaged by skidding, winching or by the equipment. To help prevent this:

1. Plan your movements carefully.
2. Put a snowmobile track around the trunk of a tree that may be damaged or leave a high stump to act as a deflector.
3. Avoid excessive turning with the logs or equipment.
4. Skid logs between November and March when the sap is not running.
5. Shorten trees to log lengths.
6. Use tow lines, not chains, to attach snatch blocks to trees.

Getting unstuck

If the tractor gets stuck while skidding a log, drop the load, drive on a bit and then winch the load back to the tractor. Remember when the load gets stuck is when back flips can occur.

If the log gets stuck, you can:

- Use a snatch block to move the log sideways.
- If the log is not too big, use a felling lever and block of wood to raise the log over the obstacle.
- If moving more than one log, you may have to remove the bottom log and continue to haul the others out and return for the stuck one. Sometimes just removing the top logs will work.
- Move the tractor so that you can pull from an angle to clear a stump or rock.

SAFE WINCHING

Operator safety

When winching, it is important to stand outside the danger zone to avoid being hit by a snapped cable or chain.

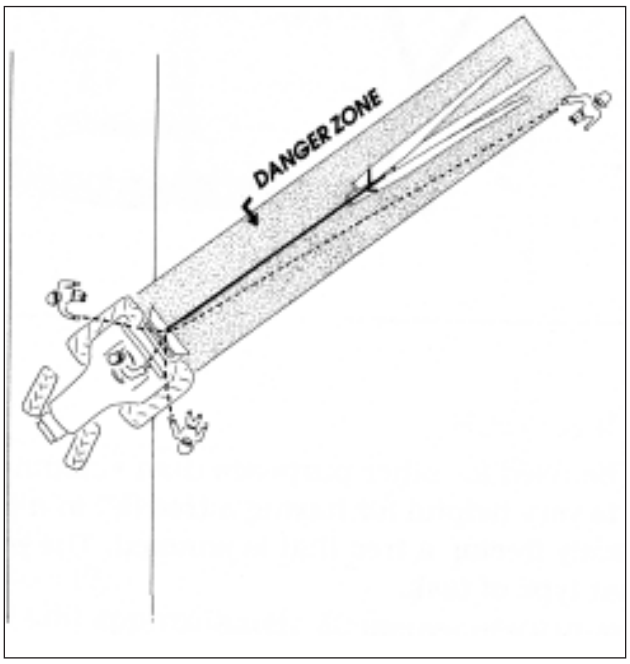


Fig 5.5 Danger zone for straigh winching

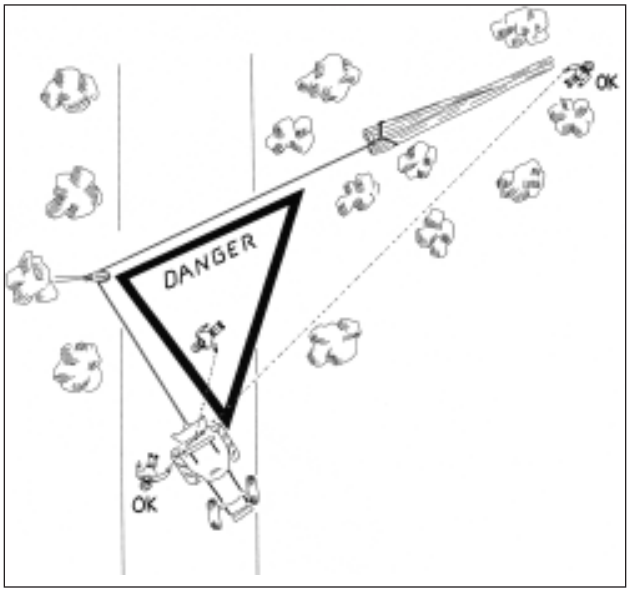


Fig 5.6 Danger zone for angled winching

Cable safety

Use braided Spectra® cable or steel cable for winching. They are both strong and don't stretch much so there will be less whiplash if it breaks. The Spectra® cable is covered in polyester which makes it safer for your hands and eyes than the steel cable.

Check cables regularly for wear and replace worn ones to PREVENT cable failure.
Cable failure is not very common on farm tractors (unless the cable is worn) as the tractor engine will usually stall if the winch is the right size for the tractor. If not, the tractor will likely upset before the mainline breaks. Chokers are usually the first thing to break.

Protective clothing

Felling trees and winching is hazardous work. You must wear the right clothing to protect yourself from the chainsaw, the cable, falling tress, branches and noise.
Wear:

- Hard hat with ear protectors and face guard (CSA approved)
- Chain saw pants
- Steel toed boots (CSA approved)
- Industrial-quality leather gloves for handling any type of cable or axes

Module Six - Chain Saw Use and Safety has more information on proper clothing.

Further reading on winching…

Using an All-Terrain Vehicle To Produce Long-Length Logs is a basic guide to skidding with an ATV.

Using a Farm Tractor To Produce Long-Length Logs provides a basic guide to winching with a tractor.

For more detail on tractor safety while winching, site layout and attachments see: ***Equipping the Farm Tractor for Forest Operations***, FERIC Handbook #11.

A useful guide to tractor winches and winching is **Foresty Implements for the Farm Tractor** , Supplement to FERIC Handbook #11 above.

Specific models of winches and company contacts are provided in ***Small Scale Woodlot Equipment***, a binder produced by the Maritime Woodlot Extension Committee.

The ***Forest Professional, Guidelines for the Stewards of tomorrow's forests*** (2001)
has a section on Protective Equipment and Clothing.

See Appendix A and B.

LESSON FIVE QUIZ

(*Answers are on last page.)*

1. Winching is done when you can get up to the log with your tractor or ATV.

_____ True

_____ False

2. When using chokers, attach the furthest tree first.

_____ True

_____ False

3. Make skid trails 40- 60 metres apart because:

a) that is the maximum hauling distance

b) that is far enough to walk

c) that is double the length of the winch cable.

4. Fell the log so that

a) the butt end is closest to the cable run

b) the top end is closest to the cable run

c) either - depending on distance from the cable run and obstacles

5. When winching with a tractor the operator should stand

a) in front of the tractor

b) to the side of the tractor

c) directly behind the tractor

LESSON SIX: FORWARDING

Forwarding is when both ends of the log are off the ground while being transported. This lesson focuses on various ways of loading trailers and forwarding with a trailer. Safe forwarding tips when using an ATV or tractor are also covered.

The logs are forwarded to where they will be picked up or processed. To reduce the forwarding distance, you can also take a portable sawmill or wood splitter to the piled wood.

LOADING YOUR TRAILER

A trailer can be loaded by hand, with a manual or hydraulic powered winch or with a loading boom. What's right for you depends on the size and amount of wood you plan to cut. Grapple loaders are also used though they are expensive and more suited to high production.

Loading using leverage

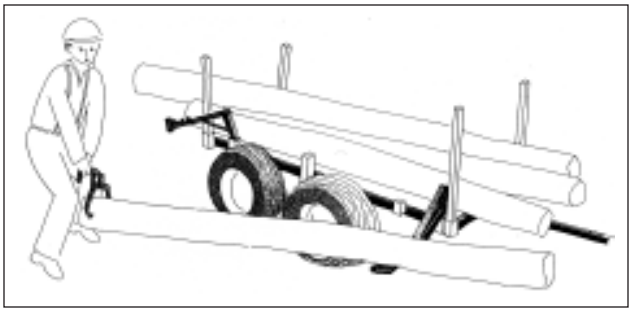


Fig 6.1 Loading a trailer by hand using leverage

This trailer has a lower and upper support for the log. Once the log is balanced on the upper support, pivot it into the trailer. When the trailer is full, attach the load to the frame with a chain and tighten it with a straight pole or use a load binder. Using leverage like this lets you load and unload 136 kg (300 lb) logs by hand.

Loading with a manual winch

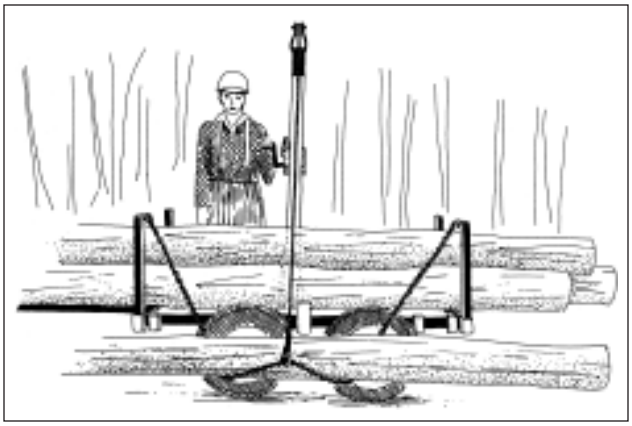


Fig 6.2 A manual winch doesn't cost much and makes loading easier

The manual winch can load logs up tp 545 kg (1,200 lb). Once the trailer is full, tighten the chain only around the load and frame using the winch and cable. To unload, attach unloading poles to the trailer stakes. Slide the cable under the log, lift it and let it roll down the poles. This is called parbuckling.

Example A

Abdul has an ATV and is skidding big sawlogs with a Yankee Yarder winch. He now needs to forward the logs out. Sawlogs are heavy to load so he decides to get a trailer with a manual loading winch.

Loading boom

This system consists of a pivoting mast and a boom with a hook on the end. A chain with a lifting tong on the end goes through the hook. This loader is powered by hydraulics from the tractor. Reusable stakes on the side keep the load in.

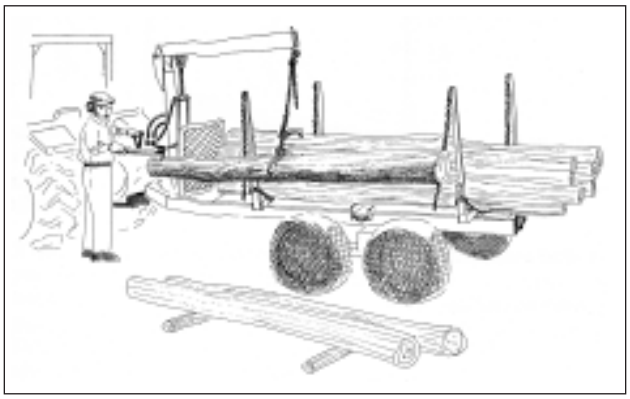


Fig 6.3 A loading boom may be ther good choice for a tractor if you have a higher volume than you want to load by hand.

Before loading, remove the side stakes but place them back before the load gets too big to do so. To load the trailer, the lifting tong is attached to the middle of a log on the pile. The boom is lifted and the operator balances the log using a pickanon (log pick). You can load several small logs using a choker.

The load is fastened with a chain that goes around the load so put it on the trailer before you begin. Chains also go across the load from stake to stake.

The trailer can be unloaded in a couple ways. You can use the boom and take the logs off one or two at a time. Or the logs can be dumped all at once by tilting the load. This is done with a tilting cross beam raised by the boom on one side while the chained load moves the stake and falls out on the other.

Example B

Remember Pauline and Bill from Lesson Five who are going to buy a tractor and skidding winch for their planned harvest of 80 cords?

They will have many small piles of wood along their skid roads and trails that need to be forwarded to create a big pile on their skid road for pickup. They will need some kind of aid to load the trailer for that much wood. They plan to buy a trailer with a hydraulic boom loader to load and unload the log piles.

SAFE FORWARDING

While modifications like chains, extra weight and ROPS may help, it is best to practice safe forwarding techniques to prevent an accident in the first place. Don't overload the trailer and try to balance the load. Also leveling off hummocks and filling in holes on the trail will make forwarding safer.

Balancing the load on an ATV

! Balancing the load on your trailer will keep you safe and on track.

If the load is too heavy at the back:

- ATV rear wheels rise up
- ATV looses traction and jack knifes

If the load is too heavy at the front:

- ATV rear gets pushed down
- ATV rolls over backwards

To check balance, lift up on draw bar, note resistance and readjust load as needed. The hitch should move easily up and down with little weight on the ATV from the trailer. Going up hill or down also changes the balance. The weight on the hitch will lessen going up hill and increase going down.

Balancing the load on a tractor

Balance the load on the trailer so that no more than 1/3 is on the draw bar. The balance can affect the traction and steering. Place logs so that butt ends alternate between the front and back and make sure the load is tight.

Slopes and curves

The main concern with forwarding is controlling the load on slopes and on curves. When going uphill with a trailer, choose one gear if possible and use that until you get to the top. Changing gear can cause a rear roll over. When going down, select a low gear that lets you use engine compression to maintain a slow speed. Try not to turn while going downhill. If you have to, be careful that the rear wheels don't swing out and jack knife the machine.

Improved braking on an ATV

As mentioned in Lesson Three, ATV brakes are not designed for forwarding a trailer of logs. Some extra precautions can be used to improve braking when going downhill with a load. These are: reduce the load, install traction chains on the rear wheels of the ATV, and drag a log behind the trailer.

For occasional use, you can also install a section of snowmobile track under the rear wheels tied to the walking beam of a bogie wheel trailer. See Appendix B for Web sites.

SAFE DRIVING

- Change gears slowly
- Depress clutch if front wheels lift up
- Use low gear going downhill
- Do not shift going uphill (automatic ATVs may be safer for this reason)
- Brake gently/ brakes can be used to help steer
- Take turns at low speeds
- Wear a seatbelt

To prevent side rollovers:

- Avoid driving across a slope with a loaded trailer. If you have to, take a small load.
- Avoid turns at the top of a slope.
- Avoid ditches.

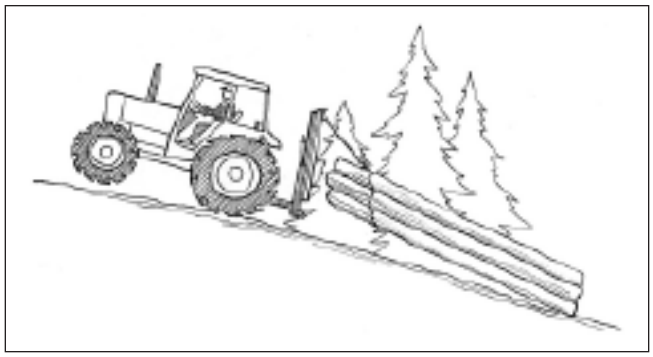


Fig 6.4 A tractor can back flip if the load gets stuck

To prevent rear rollovers:

- Distribute the tractor-load weight evenly
- Watch out for obstacles
- Start slowly and let clutch out gradually

Further reading on forwarding…

Using an All-Terrain Vehicle To Produce Long-Length Logs is a basic guide to forwarding with an ATV.

Using a Farm Tractor To Produce Long-Length Logs provides a basic guide to forwarding with a tractor.

Forestry Implements for the Farm Tractor, Supplement to FERIC Handbook #11 has more on trailers.

Specific models of trailers and company contacts are provided in ***Small Scale Woodlot Equipment,*** a binder produced by the Maritime Woodlot Extension Committee.

See Appendix A.

LESSON SIX QUIZ

(*Answers are on last page.)*

1. Forwarding is when the load is carried off the ground.

_____ True

_____ False

2. Your ATV trailer should be loaded

a) with the weight toward the front

b) with the weight toward the back

c) balanced in the middle

3. When using a skidding winch and sulky the load is skidded.

_____ True

_____ False

4. A trailer can only be loaded with a winch.

_____ True

_____ False

5. To drive your tractor and trailer safely:

a) change gears quickly

b) change gears often

c) brake hard

d) none of the above

LESSON SEVEN:
PUTTING IT ALL TOGETHER

Lesson Seven brings together the information from the previous lessons to guide you to choosing the best options for you. You may have good idea of what your main piece of equipment will be from Lesson One. Or you may have decided to go with one of the equipment options mentioned in Lesson Four. You have read about various attachments and accessories and what they can do and also about winching and forwarding.

This lesson applies your personal objectives from Lesson One to the other information in the Module. It also looks briefly at environmental concerns while harvesting wood and how you can reduce damage while using your equipment.

ENVIRONMENTAL CONCERNS

A whole book could be written on how to minimize damage to your woodlot. A good one is - Preventing Soil Damage, A Practical Guide to Forest Operations, an easy- to- read guide published recently by FERIC. Some of the main points are summarized below but you may also want to read the guide itself. See Appendix A.

Why is prevention important?

Good soil is vital to the health and future of your woodlot. It supplies food, gases, water and support to your trees. Harvesting equipment can damage the soil by compaction, rutting, and erosion which results in a loss of nutrients. Find out what kind of soil or soils you have in the area you plan to harvest (fine, organic, shallow, dry, etc). Learn about the techniques to use for your kind of soil.

Damage can be prevented first of all by matching your equipment to your woodlot and your needs and secondly by how you use it. Some modifications help in one area but cause more damage in another so some balance or trade offs may be necessary. Planning your operation in advance is the key to avoiding a situation that may cause damage.

Outfitting to prevent soil damage

- Wide trailers with a low load reduce compaction.
- Wide tires reduce rutting.
- Bogie wheels reduce compaction.
- Chains reduce slippage.

Harvesting to prevent soil damage

Planning

- Plan runs and trails to avoid wetlands.
- Cover trails, especially sensitive areas, with branches before passing over them.
- Put roads and landing so that work is done down slopes rather than up hill for less wheel slippage (if possible work when the ground is dry or frozen,otherwise it may cause rutting); however hauling wood down hill may focus water travel.

Cutting

- Fell logs in direction of cable run

Skidding and forwarding

- Avoid driving equipment in wet spots or soft soil
- Stay on designated trails
- Harvest in dry or frozen conditions
- Skid soon after cutting before soil wets up
- Drive slowly

After harvesting

- Smooth out ruts to prevent erosion
- Put in diversion ditches on trails that will no longer be used

For more information on crossing streams, and preventing erosion see **Module 11, Roads and Trails - Building it Right from the Start**. For more information on working near riparian areas see Nova Scotia Wildlife Habitat and Watercoruse Protection Regulations.

CHOOSING YOUR EQUIPMENT

You can finally now apply your objectives from Lesson One with the information from the other Lessons (summarized in Charts below) to complete the final exercise.

Note that overall efficiency may be the same for different attachments since some can take bigger loads. It will depend on how much wood you want to move in total.

Remember your list of objectives from Lesson One? Review them here. Have any changed?

Your Objectives

Check off your objectives for buying or improving your harvesting system.

_____ To harvest _____cords/m^3 per year.

_____ To harvest firewood

_____ To harvest saw logs

_____ To sell _____ cords/m^3 per year or earn $_____ in income.

_____ To maintain forest cover through selection cuts only

_____ To maximize income from my woodlot

_____ To spend time in the woods doing productive and enjoyable work

_____ To get a system that requires as little lifting as possible

_____ To get a system that is as cheap as possible

_____ To do the work myself

_____ Other

Prime Movers

These numbers on page 52 are only a guide. However, the numbers in these charts can be used for relative comparison of machine types. Generally speaking, as machine horsepower increases so does cost, thus a larger harvest will be required to make a purchase economically viable. The productivity figures are based on an average extraction distance of 100 meters on level terrain, and do not account for felling time. Skill level, terrain, extraction distance, and wood size will all impact on productivity. Maximum travel distance and annual harvest listed is based on load size, and machine speed. The larger the load and the higher the speed, the greater the distance that is feasible. However, ultimately the maximum distance will be determined by your circumstances, productivity concerns and how much you plan to harvest per year.

Purchasing equipment is an investment. It is a good idea to find someone who is working with the type of equipment you are considering to make sure it is the right decision for you and your woodlot.

(To convert from m3 to cords - m3 x 0.276 = cords)

Comparison Chart for Prime Movers

	Cost	Productivity	Limitations	Advantages
ATV 300cc and 4WD	$8,000 (new)	0.1 to 0.4 m3/ load	- Limited by terrain and stand conditions. - May requires addition of guarding to protect vulnerable components, and operator. - Woods work can be hard on plastic components of ATV. - No ROPS, FOPS or OPS specifically designed for ATV, addition of these items may invalidate warranty. - Excessive running in low gear may increase breakdowns, so select a machine with appropriate range of low gears. - Operator must be aware of the limitations of the machine with regard to logging.	- Versatility for off woodlot activities (i.e. hunting and fishing). - Many commercially available attachments for the ATV. - This choice is suitable for an ATV owner that also wants to produce limited volume of wood, usually for personal consumption. - Track kits are available for most ATVs, making them more suitable for hauling in the snow. - Good for an average annual harvest of 70 m3.
Tractor Less than 35 hp 35- 75 hp 80 + hp	$14,000 (new) $16,000 - $30,000 (new) $40,000 + (new) + up to $7,000 for addition of necessary machine guarding and protective operator structures	1- 3 m3/ hr for smaller tractors 2-8 m3/ hr for larger tractors	- Be sure to check ergonomics! If you are using a winch, you will be getting in and out a lot. A tractor with gears between the legs may not be ideal. - Requires addition of protective guards for vulnerable machine components and protective structures for the operator. - Some models can be very unstable in the woods. - Well established trails are required to obtain best results.	- Versatility for farming operations. - Tend to keep their value. - Some models available with bi-directional seats so you can swing around in the seat to load a trailer. - Some models available with closed cabs with air conditioning. - Many commercially available logging attachments. - Usually good parts available and service in most areas. - Many models and sizes available to suit most conditions. - A suitable choice for the production of personal use wood, and small volumes of commercial wood. - Tracks can be purchased fro most tractors enabling them to operate in snow. - Good for an average annual harvest of 70 m3 for smaller tractors up to 1800 m3 for larger tractors.

Off Highway Utility Vehicle / Side by Side	$ 11,000 +	0.1 to 0.4 m3/ load	- Slightly wider than an ATV.	- Versatility for off woodlot activities. - Designed to carry two people. - Options include roll cage and utility box. - Good for an average annual harvest of 70 m3.
Snowmobile	$7,500	1- 3 m3/hr	- Care, training and health of animals. - Operator must have appropriate animal skills. - Cannot be parked and forgotten at end of operations. - Productivity drops quickly as extraction distance exceeds 30 meters. - Not suitable for all terrain and stand conditions.	- Enjoyment of working with animals. - Less extensive extraction trails required. - Can be advantageous for minimizing soil disturbance on some sensitive sites.
Horse / Oxen	$4,000-$5,000 includes horse, track and trailer	1-3.5 m3/hr	- Care, training and health of animals. - Operator must have appropriate animal skills. - Cannot be parked and forgotten at end of operations. - Productivity drops quickly as extraction distance exceeds 30 meters. - Not suitable for all terrain and stand conditions.	- Enjoyment of working with animals. - Less extensive extraction trails required. - Can be advantageous for minimizing soil disturbance on some sensitive sites.
Truck Tractor	Low	1 - 3.5 m3/load	- Not available commercially. - Owner must be mechanically inclined.	- Good for an average annual harvest of 70 m3.
Used Skidder / Forward	$30,000 (price is dependant on the condition of the machine)	4-10 m3/hr	- Generally less versatile for non harvest related activities - Requires skilled operator, and a commitment to harvesting activities. - Costly maintenance.	- Purpose built, robust construction, with appropriately engineered operator protective structures. - A good choice for landowners who want to produce commercial volumes of wood. - Good for an average annual harvest of 360 m3 +

Attachments

To help you decide, consider these factors:

- **How much wood am I cutting?**
- **Cost verus How much do I want to spend**
- **Do I need to skid logs out?**
- **Do I need to forward logs?**
- **How far do I need to forward the wood?**
- **Do I need a trailer as well?**
- **Can I load it manually or do I need a loader of some kind?**
- **Am I harvesting enough to invest in a winch or trailer?**
- **Can I forward wood on the road with a truck?**
- **Is a used attachment available? Can I build it?**
- **Can some parts of the work be contracted out?**
- **What are the characteristics of my woodlot?**
- **Does it have sensitive or wet areas? riparian zones? steep slopes?**
- **Do I need more than one attachment so I can skid and forward?**
- **Do I have the time and skills to harvest my own wood? Do I have the time to learn?**

Comparison Chart for Attachments

			Maximum Efficient Extraction Distance				
	Cost	**Prime Mover**	**Skidding**	**Forwarding**	**Productivity**	**Limitations**	**Advantages**
Cable alone Steel cable Synthetic fibre cable	$100 $300	ATV	30 m		0.5 m3/hr	- Not very efficient. - Danger of back flipping prime mover.	- Low cost . - Need only a place to attach the cable to ATV. - Can be used with skidding cone, pan or grapple. - Suitable for limited use or high value logs. - Good for an average annual harvest of 18 m3.
Homemade ATV Sled	Less than $100	ATV	500 m		0.2 m3/hr	- Cannot be purchased.	- Reduces friction, and keeps logs cleaner than standard skidding. - Plans are available. - Good for an average annual harvest of 18 m3.
Self Loading Sled	$500	ATV Small Tractor	500 m		0.2-0.5 m3/hr		- Self loading feature reduces work load for operator. - Sled is light enough to be manually positioned over the end of the log and can be tied some distance from the ATV. - Lifts one end of the log off the ground reducing friction and keeping wood cleaner. - Good for extracting logs that are located behind stumps. - Good for an average annual harvest of 54 m3.

2 wheel Sulky self loading with manual winch with electric winch	$800 $900 $1200	ATV Small Tractor Horse		500 m	0.2 - 0.5 m3/hr	- With self loading models, terrain and brush must allow you to get your equipment right up to the log for loading. - Can reduce weight on front tires which can make steering difficult.	- Keeps the weight off back of machine. - Self loading sulkies are fast. - Reduces power demands on ATV. - Reduces skidding related trail damage. - Some sulkies are designed to be positioned at the back of load on a tractor to forward the wood. - Good for an average annual harvest of 70 m3.
Small Trailers with manual loading winch with electric loading winch	$2,500 $2,800	ATV Small Tractor Horse		1 km	0.8 m3/hr	- Requires good terrain. - Requires a trail network.	- Reduces ground disturbance. - Wood is cleaner than if it had been skidded. - Good for an average annual harvest of 110 m3.
Small Trailer with hydraulic loader	$10,000	ATV Tractor		1 km	0.8 m3/hr	- Requires good terrain. - Requires a trail network.	- Reduces ground disturbance. - Wood is cleaner than if it had been skidded. - Very efficient loading and unloading allowing you to move more wood.
Commercial Tractor Skidding Winch	$2,000 $3,000 $5,000	Tractor with 20-30 HP 40-80 HP 75-100 HP	30-60 m	500 m	2.0-5 m3/hr	- Requires well planned layout and harvest operation. - Must be sized right for tractor. - May require the addition of counter weighting on front of tractor. - Requires a vigilant operator to ensure the safety of those involved in logging operation.	- Allows farm tractor to stay on main trails, thus reducing wear and tear on tractor. - Good for extraction from soft or sensitive sites. - Many makes and models to choose from. - Retain value very well. - Simple technology, low maintenance and extremely reliable. - Some sulkies are designed to be positioned at the back of load on a tractor to forward the wood. - Good for an average annual harvest of 70 m3 for smaller tractor up to 1800 m3 for larger tractors.

Home made Tractor Skidding bar with electric winch	$200 $250-500	Tractor with 30-50 HP	100 m		1-2 m3/hr	- Without a means to pile wood a large landing is required for skidding tree lengths. - Significant risk of backflip if load catches on an obstacle during travel.	- Low cost. - Keeps end of log off ground for easier pulling and cleaner logs. - Good for an average annual harvest of 36 m3.
Tractor butt plate	$400	Tractor 30-50 HP	100 m		1-2 m3/hr	- Without a means to pile wood a large landing is required for skidding tree lengths. - Significant risk of backflip if load catches on an obstacle during travel.	- Low cost. - Can have hinges so that it can lift over obstacles. - Can be designed to lift load for better ground clearance. - Good for an average annual harvest of 36 m3.
Powered Trailer commercially built from an old truck	$3,600-$7,200	Tractor		1 km		- Requires good terrain. - Requires a trail network.	- Reduces ground disturbance. - Wood is cleaner than if it had been skidded. - Turns a 2WD tractor into a 4WD unit. - Good for an average annual harvest of 3600 m3.
Tractor Back Rack	$300-$400	Tractor		150 m	1-3 m3/hr 15-30 cords/yr	- Manual loading can be difficult for large amounts and large piece size. - Not available commercially. - Requires counter weighs on front of tractor. - Requires good terrain.	- Best for pulpwood or small firewood (4'-8'). - A rack on the front can be used as counter weight. - Good for an average annual harvest of 55-110 m3.
Tractor Fork Lift	$500-$1,000	Tractor		150 m	1-2 m3/hr	- Requires good terrain.	- Makes a good pair with a back rack. - Good for an average annual harvest of 55-110 m3.

Comparison Chart for Other Equipment

	Cost	Skidding	Forwarding	Productivity	Limitations	Advantages
Yankee Yarder	$1,500	60 m		1-3 m3/hr	- Slow (50-60 metres /minute). - Can only drag wood to trail side.	- Good for thinnings. - Good for an average annual harvest of 55 m3.
Chainsaw Winch	$ 1, 000 + saw	50 m			- Slower (18-24 metres /minute). - Can only drag wood to trail side.	- Good for thinnings. - Very portable. - Can be used to get your vehicle unstuck or to haul game.
Mini Skidder / Iron Horse	$10,000 +	100 m	200 m with sulky	3 m3/hr	- Limited off woodlot applications. - Slow. - Can be expensive to maintain. - Hauling capacity is small (1 m3).	- Do not need an ATV or tractor. - Good for single log removal. - Good in partial harvest situations. - Good for an average annual harvest of 110 m3. - Can be used for other hauling (i.e. moose) or with a dump box.

EXERCISE 7.1

Remember this from Lesson One?
Has it changed after reading the Module?
This exercise also asks a few more questions and looks at cost over time. Fill in your situation.

Have equipment *(List)*	**Do not have equipment**
Equipment adequate/ Not adequate *(List what is and is not adequate)*	**Decide what you need**
Buy or build equipment *(List with prices)*	

Costs/Time

Making a wise investment is important to you

The total price may seem like a lot or more than you want to spend. By going through the next part of the exercise, you can see how it is balanced against income and over a number of years.

Equipment needed	Costs	Cost to hire contractor per cord or m^3	Cords or m^3 needed to harvest to cover costs of equipment purchase	Cords or m^3 harvested per year	# of years to cover expenses	Other expenses
TOTAL						

List the attachments you are considering. Remember that more than one system may be suitable for you.

A

B

C

Conclusion

Going through all these factors and information takes time but will pay off when you invest in equipment that is right for you and your woodlot.

APPENDICES

APPENDIX A - REFERENCES

These books are available from the Nova Scotia DNR Library in Halifax and can be ordered into your local library through Inter Library loan. Check with your local library or order them on-line through the Nova Scotia Provincial Library site if you are a member.

1. ***Using an All-Terrain Vehicle To Produce Long-Length Logs***, OPBRQ (Office des Producteurs de Bois de la
   Region de Quebec - Office of Quebec Wood Producers) with assistance from Feric 1995

2. ***Using a Farm Tractor To Produce Long-Length Logs***, OPBRQ (Office des Producteurs de Bois de la Region de Quebec - Office of Quebec Wood Producers) with assistance from Feric 1995

3. ***Equipping the Farm Tractor for Forest Operations***, B. McCallum, FERIC Handbook #11, 1993.

4. ***Forestry Implements for the Farm Tractor***, Bruce McCallum, Supplement to FERIC Handbook #11 above. 1995.

5. ***Small Scale Woodlot Equipment***, a binder of specific equipment and dealers produced by the Maritime, Woodlot Extension Committee., 1996

6. ***Preventing Soil Damage in the Boreal and Acadian Forests of Eastern Canada***. A Practical Guide for Forest Operations, Advantage Series Vol 6. No. 27. FERIC 2005

7. ***Chain Saw Use and Safety***, Home Study Module Six, NSDNR

8. ***Roads and Trails - Planning It Right from the Start***, Home Study Module Eleven, NSDNR

9. ***Spectra Rope for Skidder Mainlines***, A FERIC guide .

10. ***The Forest Professional, Guidelines for the Stewards of tomorrow's forests*** (2001)
    NS Department of Environment and Labour.

Conversions:

1 ha = 2.46 acres
1 cord = 3.625 m^3
1 kg = 2.2 lbs

HOME STUDY SERIES

These modules are available free from the
Nova Scotia Department of Natural Resources
PO Box 698
Halifax, Nova Scotia
B3J 2T9
Telephone: (902) 424-5444
Toll free: 1-866-226-7577
E-mail: woodlot@gov.ns.ca

You can get more information and sign up on our web site at:
www.gov.ns.ca/natr/regional/extension.

1A. *A Getting More from Your Woodlot: An Introduction to Integrated Resource Management*

1. *Introduction to Silviculture*
2. *Harvesting Systems*
3. *Thinning for Value*
4. *Wildlife and Forestry*
5. *Stand Establishment*
6. *Chain Saw Use and Safety*
7. *Woodlot Ecology*
8. *Wood Utilization and Technology*
9. *Woodlot Recreation*

10A. *Managing Woodlot Finances: Planning and Investment Guide*

10B. *Income Tax and Estate Planning Guide*

11. *Roads and Trails - Planning It Right from the Start*
12. *Small Scale Harvesting Equipment - What's Right for You?*

APPENDIX B - FOR MORE INFORMATION

FERIC - Eastern Division
580 boul. Saint-Jean, Pointe-Claire, Quebec, H9R 3J9
Phone: (514)0694-1140, E-mail: admin@mtl.feric.ca
Web site: www.feric.ca

NS Department of Environment and Labour
Main Office
5151 Terminal Road, PO Box 697
Halifax, NS B3J 2T8
Phone: (902) 424-5300
Web Site: www.gov.ns.ca/enla
Plus local offices *(see web site)*

NS Department of Natural Resources
Main Office - Founders Square
1701 Hollis Street
Halifax, NS B3J 3M8
Phone: (902) 424-5935
Library: (902) 424-8633
Web site: www.gov.ns.ca/natr
Plus local offices *(see web site)*

Atlantic Forestry Review magazine Retailer ads and used equipment. Available by subscription.
DvL Publishing, Liverpool, Queens County
902 -354-5411 and 1-877-354-3764 (toll free) and from some newsstands.
Call to enquire where you can buy it.

The Green Pages
A directory of equipment dealers, contractors and consultants that comes out every two years
Also prodcued by DvL Publishing. Call them to buy a copy or look through one at your local DNR office.

WEB SITES

ATV attachments:
http://www.motherearthnews.com/Alternative_Energy/2003_April_May/All_Terrain_Utility_Vehicles

Pivoting log arch and capstan winch, also using snowmobile track to improve ATV braking:
www.novajack.com

ATV manufacturers:

Arctic cat	www.arcticcat.com
Argo	www.argoatv.com
Bombardier	www.bombardier-atv.com
Gorilla Vehicles	www.gorillavehicles.com
Honda	Hondamotorcycles.com
John Deere	www.johndeere.com
Kawasaki	kawasaki.com
Polaris	www.Polarisindustries.com
Suzuki	Suzukicycles.com
Yamaha	Yamaha-motor.com
MAX All-Terrain Vehicles	maxatvs.com

Stand alone winch:
http://Lewiswinch.com

Mini-Skidder in action:
http://www.tiltonequipment.com/Jonsered/Tilton_Jonsered_iron_horse_images_page.html

Educational web sites

Virginia Tech - Virginia Copperative Extension
http://www.ext.vt.edu

Washington State University - Department of Natural Resouce Sciences Extension
http://ext.nrs.wsu.edu

Univeristy of Minnesota Forset Resources Extension
http://www.cnr.umn.edu/FR/extension/

Forset Infor for the San Juan Islands
http://www.rockisland.com/~tom/tools.html

Ontario Woodlot Association
http://www.ont-woodlot-assoc.org/sw_smallscalelogging.html

North American Horse and Mule Loggers Association Inc.
http://www.pacinfo.com/~dfrench/horselogging/main.html

APPENDIX C - GLOSSARY

Cone: This is a metal cone shaped accessory attached to the end one or more logs when skidding to help them slide.

Forwarding: This is when logs are transported with both ends off the ground.

Grapple: A grapple is a set of tongs attached to the end of a cable to skid or load a log.

Ground speed: Ground speed is when the speed of the PTO varies with the speed of the tractor on the ground rather than the RPMs of the engine.

Hydraulics: Hydraulics is a power system using hoses and pressurized fluid.

Pan: A pan is a metal accessory used like a pan except it can take two or more logs.

PTO: This stands for Power Take Off. This is a power system that works off the drive shaft off the engine.

Riparian zones: These are areas along streams and other waters where less cutting is allowed to protect wildlife habitat and improve water quality.

Skidding: This is when one or both ends of the log are on the ground while being moved.

Three point hitch: This is a setup on the back of the tractor that moves up and down and where attahcments can be bolted on.

Winch: A winch is a drum and a cable system used to winch in logs. It can be powered by hand, hydraulics, the PTO or be electric.

Winching: This is when a log or logs are attached to a cable and then moved along the ground toward the machine or person supplying the power.

QUIZ ANSWERS

Lesson One

1. E
2. C
3. False
4. True
5. D

Lesson Two

1. A
2. A
3. False
4. True
5. D

Lesson Three

1. D
2. False
3. True
4. F
5. B
6. B
7. False
8. E
9. D
10. False

Lesson Four

1. D
2. False
3. B
4. True
5. B

Lesson Five

1. False
2. True
3. C
4. C
5. B

Lesson Six

1. True
2. C
3. False
4. False
5. D