Working in Harvesting Teams

work environment | quality | production



Part 2 Practical production

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Chapter 1: HARVESTING FORESTS

THE HARVEST – A SYNERGY OF DIFFERENT COMPONENTS

Knowledge of diverse subjects is required to properly carry out harvesting operations. Various kinds of fundamental information have to be interpreted and applied to do the work properly. Insight about how different tasks should be carried out is also necessary. Therefore, a number of **different** kinds of knowledge have to be applied in an integrated manner.

Efforts have been made here to describe a harvesting project logically, step by step. Each of the component tasks and aspects is important and requires **specific knowledge**, **understanding and conformance with specific information**.

THE INSTRUCTIONS

Harvesting site directives

Instructions covering the harvesting components of a project are often called harvesting site directives. The main target is the harvester operator. This is, of course, the person who has the most responsibility for the actual harvest. However, any kind of instruction or information should also be given to the forwarder operator. The whole team should be informed about all aspects of the project. Questions covering the optimizing and sorting of different assortments, the landing site, nature conservation, etc. should be dealt with as quickly as possible. The answers should be provided in written form to all team members so that everyone is informed and in agreement.

Make sure there are always written instructions in the machine that cover all assortments. This document should be available in the forwarder and the harvester!

Nature conservation

General nature conservation activities are al-

ways included in the team's tasks. They are done without pre-planning, i.e., the planning and execution are part of the harvesting work. In addition to handling general nature conservation issues, there may be more specific aspects to take into account. An appropriate instruction sheet should describe the kind of general nature conservation expected, and any special aspects that should be taken into account.

The thinking behind nature conservation is not static. It gradually changes over time. This should be considered a positive feature, indicating that efforts to conserve nature are gradually improving (hopefully). Informative material is available on the market that describes the kinds of natural and cultural features that should be considered, and how they should be conserved.

Certain issues concerning nature conservation are:

- What flagging tape color(s) are used and what do they signify?
- Footpaths, brooks and streams should not be driven across unless there is no other solution. There should be as few crossings as possible. Build a bridge across a stream or lay a culvert if this can reduce the damage caused. (See Book 1, Chapter 8, which covers water care.)

Culture conservation

Various culture conservation activities may be required. In such situations the supervisor should provide information on what is known and/or things you have to specially look for. You must also know the kind of flagging tape color that is used.

Information on known ancient burial ground remains can be found at the Swedish Central Office of National Antiquities' Ancient Re-

Felling method for the largest trees

Chapter 13, Part 1.





The second cut will be placed above the first, which seldom (or never) is a good method.

The second cut will end up level with the first, which is acceptable.





The second cut is intended to be lower than the first. This method is best when two cuts are used when felling thick trees. See also photos and sketches covering this method in Part 1, Chapter 13: Scaling regulations.

MAX. 10 CM OR REJECT!

The circled cut acts as a notch. In a "tight situation" this method is very useful. It provides better control of the felling work and radically reduces the risk for felling cracks.



Chapter 2: FORWARDING - BASIC CONCEPTS

FORWARDING WORK HAS MANY COMPONENTS

Forwarding work is very complex, i.e., it has many components. To describe forwarding properly each of these components should be considered systematically. Thus, the goal in this document is to present them in a simple, clear and logical order.

OPERATING THE LOADER

Smooth loader movements

The loader can certainly be operated quickly, but it is more important that the movements are precise and smooth, for several reasons. One important reason is to minimize shocks to the hydraulic system, the loader and the operator's work environment. Smooth movements of the loader are beneficial for the loader and extend its life span. Skillful, smooth operation of the loader means less vibration and a more comfortable operator's environment. From the latter perspective, it is particularly important that the loader be operated smoothly if it is a **smaller machine**, especially if it is **mounted on the cab section**.

Jerky loader operation results in more pressure shocks

Despite major advances, today's hydraulic technology is still not perfect, especially for functions requiring movements of large amounts of oil. One such function is the telescopic boom, which consumes a lot of oil at maximum speed. When you run the telescopic boom into the bottom at full speed there is suddenly superfluous oil in the system, which can cause small jerks in the loader. Running a grapple at full speed creates a similar reaction when the movement stops. The continuing momentum of oil in the system when the movement suddenly stops, for any reason, results in pressure spikes. These spikes cause varying degrees of damage, depending on how well the hydraulic system has been designed.

The pressure shocks that may occur in the hydraulic system can be explained as follows: If the movement of a hydraulic system suddenly stops, the momentum of the oil persists, and this hydrodynamic effect creates a pressure shock.

Only use essential loader movements

Do not move the loader unnecessarily. For example, you should not close the grapple when you place it on the load. This movement results in unnecessary work, wear on the grapple and energy consumption.



Avoid closing the grapple when you put it on top of the load.



By extending the telescopic boom almost to its maximum position, you can minimize the risk of the boom hitting the cabin roof. Think about this when using this motion; you must operate the loader very carefully. There is a risk of denting the cab. Besides this mishap, the pistons in the crane's slew cylinders may hit the bottom. If this happens too quickly you will risk a crane slew breakdown.

By extending the telescopic boom almost maximally you minimize the risk of the main lifting boom hitting the gate.



Chapter 3: THE WORK AT THE LANDING SITE

UNLOADING ON THE LANDING, BASIC CONSIDERATIONS

When you have unloaded and piled the wood on the landing and correctly marked each pile you have finished the harvesting work for that particular volume of wood. It is important that the piling and marking have been properly done since you are handing over the wood to the person responsible for further transport.

How the work on the landing should be done is described below. The procedures are guided by the scaling regulations and the rules describing how to pile wood into different assortments. You will also find suggestions about how to make the work progress as smoothly as possible.

Positioning

Make sure that you position the forwarder correctly when you are unloading and piling. Position your machine approximately one meter from the vertically flattened side of the pile if possible. The landing should have been planned sufficiently well so that you are standing on level ground. Unloading when standing on a side slope is very uncomfortable and often takes longer as the loader must work much harder. Loading in an uphill position can also be very time consuming because the wood may slide backwards when you grapple the wood (over the loading space). This is most likely to happen if the wood is slippery, such as newly cut wood in the spring or ice-covered wood in the winter.

> When unloading, a distance of one meter between the forwarder and the pile is often optimal. In addition, the machine should be level, both sideways and lengthways.





When unloading, the grapple can be quickly filled if you first grapple the wood in one side of the load.



The grapple can also be quickly filled from the left side of the load.

After unloading from both sides a small mound is left in the middle. Therefore the grapple can also be quickly filled here.



Chapter 4: FORWARDING SYSTEMS

The two previous sections on forwarding considered basic aspects of operating a forwarder. However, there are several sub-goals that must be satisfied in forwarding work; these are described in the following pages.

LOADING ON A DOWNHILL SLOPE

Harvesting should be planned in such a way that all loading of the forwarder takes place with the forwarder on flat ground or facing downhill. Loading with the forwarder facing uphill is difficult, time-consuming, and can be impossible if the slope is too steep.



This operator is trying to load with the forwarder facing uphill...



Loading while facing uphill is straightforward until this point...

Picking up wood that has slid off or been dropped is time-consuming.



However, it is almost impossible to make the wood stay in place when opening the grapple.





This harvesting site contains an area with wet soil that has a low carrying capacity and cannot properly support the weight of a fully loaded forwarder. Therefore, in such cases, the instructions should state: Start forwarding in the area with poor carrying capacity! Then there will be many opportunities to "top up the load" and thereby get a full load.

In this situation, it is important for the forwarder operator to have a well-established working routine. In addition, the work should be carried out in daylight.

Chapter 5: IMPROVING THE MAIN TRAIL

IMPROVING THE MAIN TRAIL BY DIGGING

Quite often the operator tries to improve the quality of the main trail during his day-to-day work. This is useful for him in two ways: it allows him to maintain a higher speed with the forwarder and makes his working environment more comfortable. Moreover, it reduces the wear and tear on the machine's chains, tires, and power train. In some cases, it may even be necessary to improve the quality of the trail to make it useable when driving a fully loaded machine.

The time and effort that should be invested in maintaining the trail will depend on its current condition and the volume of wood to be forwarded along it. However, before starting any substantial maintenance work, it should be discussed with your supervisor.

The following section describes a few methods for improving the quality of the main trail.

Use the grapple to remove obstacles

The main trail is often maintained using the grapple. The simplest method is to remove stones that are major obstacles, which is fairly straightforward if they are not too big.

Dig up stumps

Trails sloping sideways can cause problems during forwarding. Stumps increase the steepness when located on the upper side of the slope. It takes relatively little time to dig up small- and medium-sized stumps using the forwarder's grapple and thereby make the trail's surface more horizontal. When doing this, position your machine so that the excavated area is not too close to the forwarder, preferably below the stump. **Dig and pull the material downhill, taking care to avoid hitting the side of your cabin with the grapple.**

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The operator collects a full grapple load of spruce branches.

Before the operator places the full grapple on the load, he "shakes" the branches.



Kap. 6: PLANNING THE LANDING SITE

One of the goals of any harvesting operation is to produce a number of different assortments, i.e. **the various types of wood required by the forest products industry.** However, many steps are required to convert trees felled in the forest into an assortment that can be delivered to a sawmill's terminal.

DIFFERENT AREAS OF RESPONSIBILITY

The responsibility of the forwarder operator

The forwarder operator plays a key role in converting felled trees to a finished assortment. He is responsible for sorting the wood into assortments, piling it in a suitable fashion, and marking the piles; once these tasks are done, the work of the harvesting team is complete. However, for the transportation of the wood to proceed smoothly, the landing site has to be carefully prepared and the work conducted there must be done precisely.

The client identifies the place for the landing site

As a rule, the client selects the location of the landing site and is responsible for its layout. There is often a written agreement that outlines the site's specifications. However, as the forwarder operator you remain responsible for the detailed planning of where individual assortments are to be left. Failure to do this in a suitable fashion can cause numerous problems, not least for the drivers who are responsible for moving the assortments to their next destinations.

CONDITIONS VARY

The conditions at the landing site can vary greatly from one harvesting location to the next. Consequently, each site presents new challenges and new factors that must be considered when planning loading work. The following section provides a checklist of important factors to consider when **planning** a landing site.



Bear in mind that the loader must be able to reach the most distant underlay.

the following discussion focuses exclusively on trucks equipped with loaders with a reach of 7.5 meters.

The loader must be able to reach the last bed or bundle of wood

The handbook on "Transporting wood from the forest to industrial sites" says that "wood should be piled on a robust material (underlay) to minimize the risk of contamination (rocks, gravel, etc.)".

If the wood is piled on an underlay, then you must plan the pile in such a way that the truck can reach the area of the underlay that is furthest from the road. If the rear part of the pile was laid on a "bundle of wood (bedding)", the same considerations apply. The pile must be placed sufficiently to the road that the trucker can reach all the logs with the loader.

If the underlay is placed on the same ground level as the road, the loader has a reach of around 5.5 meters measured from the side of the truck when stretched out perpendicular to the road.

The loader must be balanced without re-grappling

Sometimes it is suitable to build a pile without using an underlay or bedding, notably when the wood is piled on thick snow. However, the trucker must still be able to grapple and **balance** the wood (without having to re-grapple).

CHAPTER 7: HANDLING "GROT" - AN INTRODUCTION

A COMPLEX SUBJECT THAT HAS BEEN DIVIDED INTO THREE CHAPTERS

GROT handling is very complex. Therefore, different aspects are presented in three chapters to create a clear structure and make the subject easier for the reader to understand. Despite this division all people involved in handling GROT should read all three chapters. Chapter 7 provides an introduction to GROT, Chapter 8 describes how to prepare and handle it, while Chapter 9 describes how to forward and transport it.

Summary in point format

Some of the parts contain a fair amount of text. Therefore, a summary has been created for each of these parts, in point format, giving the reader a brief overview of the information.

"GROT" - WHAT IS IT?

Branches and tops from harvested trees are often called harvest (or logging) residues or forest slash. When these branches and tops are harvested for creating fuel, the material is called "GROT" after the Swedish acronym (see illustration for explanation of the word). This assortment can also include understories that have been cut down, i.e., stems that have been cut at stump level!

In principle, harvests of stemwood and/or branches from younger or older stands (i.e., final harvests) where the goal is to produce a fuel are covered by the same rules as for handling GROT.

A fuel is created from GROT: forest chips

Normally GROT is processed into small chips which subsequently become a "ready-to-use" fuel that is processed in a chipper or a grinding mill. Processing in the grinding mill is not covered in this publication. The finished fuels, which are considered here, are processed in a chipper and are called forest chips. Chips processed from tree sections are also called



"GRenar Och Toppar")

MOISTURE CONTENT EFFECTS ON THE VALUE



content, approximately

55%

Increased costs for road transportation: paid per ton

Net income from fuel

Increased moisture content - lower fuel value

lenge to reach acceptable profitability is to optimize the logistics so that handling is executed rationally. If any part of the GROT handling chain fails to work properly, it will cause the total GROT handling project to become a "no profit" operation!

content, approximately 30%

(but check current assess-

ment regulations)

Cost sensitivity - what factor has the largest impact?

One of the factors that most strongly impacts the economic viability of GROT handling is its moisture content. The district heating plant pays the seller for the amount of energy derived from the fuel, and a high level of energy bears a strong relationship to low moisture contents. Since transport by truck is often paid by weight, it is less costly to transport a relatively "dry" fuel. High fuel moisture affects economic returns in two ways. A drier fuel will provide:

- a higher energy value and, thus, a higher payoff;
- lower transport costs since the fuel is lighter.

The weight of the fuel usually limits the volume the truck can transport.

Considerable time spread - difficult to establish connections

The long delay between harvest and delivery to the district heating plant complicates evaluations of effects of variations in specific steps in the process on the outcome. It is, therefore, difficult to establish clear connections between how well the work is done and the quality of the fuel. However, this is essential for the development of good methodologies.

THE FUEL BUYERS

The market for GROT is very seldom local. GROT/chips can be transported by road, rail or boat so potential buyers may have widely varying locations, even abroad. Buyers are both small and large heating plants.

Different buyers have different conditions - and demands

For district heating plants to function well they must have clear fuel specifications, which state the desired criteria for the fuel. However, the district heating plants have different requirements, since they may have different plant

CHAPTER 8: HANDLING GROT – PLANNING AND PREPARATION

ZERO TOLERANCE – COMPLETELY CLEAN GROT

By definition, GROT consists of branches and tops, but the assortment may also include understory trees and bushes that have been **cut down using a saw**.

Certain substances can, however, **never be mixed with** GROT:

- No understory trees and bushes that have been pulled up with the roots attached.
- No parts of roots of any kind.
- No mineral soil or rocks.

(Mineral soil includes weathered or sedimentary particles, i.e. sand, silt and clay.)

Moss is never permitted since mineral soil, and sometimes rocks, will be attached to it.

Pieces of metal are never permitted since they can cause a chipper breakdown.

Pieces of metal that have been accidentally dropped or lost

Various pieces of metal may be accidentally lost on the worksite. Examples include: spacing saw blades, chainsaw bars, hydraulic hoses, stakes and even a replaced wheelaxle left at the worksite. If any such "losses" occur on a site where GROT is harvested, these metal objects can end up mixed in with the GROT and cause serious damage to the chipper. This kind of damage can cause economic hardship. The contractor can lose a substantial amount of money. Ways to handle "lost" metal objects are covered later in this chapter.

FACTORS AFFECTING THE DRYING PROCESS

Drying GROT is fundamentally simple. The handling of GROT should be considered in the

same way as drying fuel wood or wet clothes outdoors! Most importantly for the drying process, the pile of GROT should be well exposed to sun and wind. Biofuel, under normal conditions, will dry best during the period March-July. During the rest of the year it is more important for the pile of GROT to be properly covered.



Factors promoting the creation of dry fuel: The heat from the sun and proper air circulation create good conditions for a relatively dry fuel.



Felling should be done in a certain direction in relation to an imaginary sight line.

Correct felling direction

In a harvest operation that includes GROT the felling direction is very important for efficient operation. The conditions vary, hence there are immense permutations of situations. The goal should be felling each tree in the right direction, in relation to an imaginary sight line.

Work principles for GROT harvesting

The following examples illustrate the recommended work methods for various situations in which GROT is harvested. The exact felling direction varies with species, tree length, and the possibility for the operator to feed the tree forward while it is falling. Of course the "real world" offers unlimited permutations of conditions and challenges that will affect the work. There could be boulders on the ground where the wood should be piled, or a steep slope that makes the work more difficult. Groups or individual trees that should be conserved, seed trees or a huge birch tree standing in the middle of the "sight line" will also affect the work.



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CHAPTER 9: GROT FORWARDING AND FURTHER TRANSPORT

THE FORWARDER EQUIPMENT

Most types of work require a certain type of equipment for optimal results and cost-efficiency. This also applies to GROT harvesting. The recommended equipment is described below in point format.

- The "correct" type of forwarder
- Slash grapple
 - Slash grapple with higher capacity
 - Slash grapple with cross-cutting saw
- Equipment for compressing loads
- Load surface extension
- Soft Ground Tracks
- Stake extensions must be solidly attached
- Use colored "signaling" paint
- Flagging tape and/or brightly colored paint

The above points will be individually explained under separate headings.

The "correct" type of forwarder

A load of GROT contains a large amount of

air. Therefore, load weights are seldom (if ever) as high as those in roundwood forwarding. A commonly held opinion is that a "medium-size" (10 - 12 ton) forwarder is the optimal choice for GROT forwarding.

Slash grapple

A GROT forwarder must be equipped with a slash grapple. It facilitates the work and substantially reduces the risk of picking up contaminants with the GROT. Despite this, using a slash grapple far from guarantees that no mineral soil and rocks will be picked up with the GROT.

Slash grapple - higher capacity

A "conventional" grapple, designed to handle roundwood, does not function well in GROT forwarding. The grapple can easily "stop dead" during loading. Equally frequently the grapple is difficult to open since branches enter the space between the grapple arms when the grapple



Using a slash grapple is an absolute must when forwarding GROT or tree sections.



The operator grapples the GROT with the intention of not letting the grapple arms dig into the ground surface. He grapples "carefully" so that the grapple is not closed more than necessary.



Without closing the grapple any further, the operator lifts the load away from the ground – approximately 0.5 meters.