Natural Resources Conservation and Development Level III

Based on March 2018 OS, Version 3

Module Title: Performing Forest Harvesting and Post harvesting Techniques

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East Arica Skills for Transformation and Regional Integration (EASTRIP) Project

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L #87	LO #1 Conduct pre-harvesting survey

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Identifying OHS requirement
- Accessing and utilizing relevant source of information
- Delineati and estimation of area to be harvested
- Identifying Mature trees and shrubs
- Allocating the required resource

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify OHS requirement
- Access and utilize relevant source of information
- Delineation and estimation of area to be harvested
- Identify Mature trees and shrubs
- Allocate the required resource

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.
2. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
3. Accomplish the “Self-checks” which are placed following all information sheets.
4. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
5. If you earned a satisfactory evaluation proceed to “Operation sheets
6. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
7. If your performance is satisfactory proceed to the next learning guide,
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Information sheet 1. Identifying OHS requirement

1.1. Introduction

Occupational health and safety (OHS) relates to health, safety, and welfare issues of the workers in the workplace. It includes:

- Laws
- Standards and
- Programs

It makes the workplace better for workers, along with co-workers, family members, customers, and other stakeholders. In addition OHS provides basic and more detailed information on the dangers to human health and safety posed by some forest activities and identifies measures that can be taken to mitigate these.

Occupational health and safety hazards in any forestry projects primarily include:

- Physical hazards ·
- Noise and vibrations ·
- Fire ·
- Chemical hazard etc.

1.2 Identifying OHS requirement

Wood harvesting must be well planned and organized in order to make the best use of the raw material while keeping labor input and production cost low and minimizing damage to the environment. Forestry is one of the most dangerous of all occupations; it is sometimes called a **"3D"** job – **dirty**, **difficult** and **dangerous**. Occupational health and safety in forestry can be greatly improved through:

- Adequate worker training
- supervision and
- The use of safety equipment.

1.1.1. Personal Protective Equipment (PPE)

Personal protective equipment that required in forestry operations are:

- Safety helmet

- Boots and safety shoes
- Safety cloth fitted to the workers-
- Gloves
- Ear muffs
- Goggles
- Helmet etc.

Figure 1 Personal protective equipment

1.1.2. First aid

First aid is the first and immediate assistance given to any person suffering from either a minor or serious illness or injury. The primary goal of first aid is to prevent death or serious injury from worsening.

Figure 2 First aid kit

The key aims of first aid can be summarized with the acronym of 'the three **Ps'** as Preserve life, Prevent further harm and Promote recovery

- **Preserve life:** The overriding aim of all medical care which includes first aid is to save lives and minimize the threat of death. First aid done correctly should help reduce the patient's level of pain and calm them down during the evaluation and treatment process.
- **Prevent further harm:** Prevention of further harm includes addressing both external factors, such as moving a patient away from any cause of harm, and applying first aid techniques to prevent worsening of the condition, such as applying pressure to stop a bleed becoming dangerous.
- **Promote recovery:** First aid also involves trying to start the recovery process from the illness or injury, and in some cases might involve completing a treatment, such as in the case of applying a plaster to a small wound.

1.1.3. Safety procedure during operating and maintaining machines

- Tree felling procedures

During tree felling:

- ✓ Always have an escape route cleared at a 45-degree angle opposite to the felling direction,
- ✓ Always keep your eyes on the tree as it falls;
- ✓ Move away from the stump as the tree falls and.
- ✓ Avoid felling trees uphill.

- Avoid environmental impact during logging and transport

Environmental issues in forest harvesting operations primarily include:

- Habitat alteration and loss of biodiversity
- Water quality
- Soil productivity
- Hazardous materials management
- Visual impact

Intensive harvesting for energy production removes a disproportionate amount of nutrients relative to biomass and may also lead to site degradation or off-site impacts resulting from use of heavy equipment on sensitive soils.

These impacts can avoid by:

- ✓ Following appropriate harvesting procedures
- ✓ Applying basic safety rules in harvesting and post harvesting operations
- ✓ Prepare schedule and organize material input for preventive maintenance etc.

Self-check 1	Written test

Test 1: choose part (2points).

1. From the following which one is of first aid

A. Preserve life B. Prevent further harm C. Promote recovery D. All

2. Occupational health and safety (OHS) includes

A. Laws B. Standards C. Programs D. All

Test II. Short Answer Questions

1. Define Occupational health and safety (OHS) (3 point)
2. List Personal Protective Equipment required (3 point)
3. List Environmental issues in forest harvesting operations (2 point)

Score = _____
Rating: _____

Answer Sheet

Name: _____

Note: **Satisfactory rating 10 points** **Unsatisfactory - below 10 points**

Information sheet 2. Accessing and utilizing relevant source of information

Information is defined as news, knowledge, instruction and required procedure received or given from one to another. An example of information is what's given to someone who asks for background about forest operation activities. Information is the summarization of different types of data. Accessing and utilizing information at workplace environments, through technological developments have automated work processes that were previously done by manual labor whilst.

The information on timber and other resource values collected during a pre-harvest survey will be used to:

- Develop harvest and renewal prescriptions that:
- Maintain site productivity
- Reduce resource use conflict
- Mitigate potential negative impacts
- Make operations more efficient/effective
- Conserve biodiversity
- Contribute to sustainable forest management

New professions and work tasks have emerged in response to new methods of creating, sharing and using information. Information management in the workplace provides a comprehensive account of information in the modern workplace. It includes a set of chapters examining and reviewing the major concepts within workplace information, from over-arching themes of information cultures and ecologies, to strategic concerns of information management and governance, and to detailed accounts of questions and current debates.

The most important and relevant sources of information during forest pre-harvesting activities include:

- Internet, related books and related materials
- Organizational rules, regulation and guidelines document
- Internet, related books and related materials
- Technical manuals
- Workplace guidelines

- Recorded documents/logo/history

In addition there is other source of information that may have value for the employers and employees as source information.

Associated information that includes species, age and management history can be collected from:

- Past records/maps,
- Aerial photos,
- Satellite imagery and
- Ground surveys.

In a high-risk occupation like forestry, relevant information and job-specific safety regulations are a critical element of any strategy to reduce the high frequencies of accidents and health problems. To develop such regulation and to obtain compliance is unfortunately much more difficult in forestry than in many other occupations. Information concerning occupational safety legislation and existing general regulations are often not specific for forestry.

Information regarding safety rule and legislation usually merely lays out some basic principles such as:

- The employer is primarily responsible for the safety of employees and must take the necessary protective measures.
- Employees must be involved in this.
- Employees in turn are obliged to support the employer's efforts.
- Laws are enforced through the labor inspectorate, the health service or an analogous body.

In addition regulations on prevention of accidents and occupational diseases often specify a number of points, such as:

- The duties of employers and employees
- The consultation of doctors and other occupational safety specialists

In forestry work primarily critical operations that required relevant information as a safety rule and regulation are:

- Activities related with felling and working with trees
- Extraction, storing and transporting wood
- Working with wind-felled trees

- Climbing trees and working in tree tops etc.

Self-check 2	Written test

Test 1: choose part

1. Associated information that includes species type, age and management history can be collected from (1 point)

   A. Past records/maps B. Aerial photos

   C. Satellite imagery and D. Ground surveys E. All

Test 2. Short Answer Questions

1. What is information (3 points)
2. Why information on timber and other resource values collected during a pre-harvest survey? (3 points)
3. List the most important and relevant sources of information during forest pre-harvesting (3 points)

Answer Sheet

Score = _____

Rating: _____

Name: _____

Note: **Satisfactory rating - 10 points Unsatisfactory - below 10 points**

Information sheet 3. Delineating and estimating of area to be harvested

2.1. Planning forest harvest

Before harvesting starts, the principal and contractor should agree on a plan for the area to be harvested. At this time, principals and contractors should share information on any potential hazards involved in the work or the site, as well as other health and safety management requirements. The harvest plan should include the principal's requirements for the tree felling operation.

The harvest plan should contain the following information:

- Maps showing road and landing locations as well as key landmarks;
- Terrain
- Mean tree height;
- All known felling hazards including:
  - ✓ Natural features like cliffs and tomos
  - ✓ Physical features like power lines and fences;
  - ✓ Stand features like areas of wind-throw, dead trees and vines;
- Stand characteristics including piece size, species, pruned/unpruned and
- Resource consent conditions.

This harvest plan should be used by the contractor when developing a tree felling plan. This felling plan should include the identification of areas of wind-throw or steep terrain and other issues that should be communicated to their crew before the harvest starts.

Planning of forest harvests is one part of overall forest management planning, which is itself a component of comprehensive land-use planning. Harvest plans are of two types: strategic and tactical. The strategic harvest plan, prepared by the forest planning team, is a long-term plan that answers the following questions for the forest or concession area as a whole is:

- What type of harvesting must be done;
- Why it must be done;
- Where it must be done;
- When it should be done.

The strategic harvest plan should demarcate non-harvest areas, divide the harvestable forest into annual operating areas (coupes) and design the main transportation system. The tactical harvest plan, prepared by the team directly responsible for supervision of harvesting operations, is a short-term plan that answers the following questions for each coupe:

- How the harvesting is to be done, in detail
- Who will carry out the operations
- When each part of the coupe should be harvested.

These comprehensive plans of forest harvest provide detailed information on:

- Forest types, volume and products;
- Soil types and erodibility classes;
- Watercourse classification by catchment size;
- Archaeological and cultural values;
- Fauna and flora values;
- Road standards;
- Harvesting prescriptions and methods; and
- Regeneration prescriptions (natural or artificial regeneration, plantation establishment, advanced regrowth retention etc.).

2.2. Delineating area to be harvest

Set-up mapping and pre-harvest inventory are done consecutively before tree harvesting.

The following tasks may be distinguished:

- Establishing set-up boundaries
- Establishing buffer zones
- Marking harvestable trees and cutting climbers if necessary
- Locating and marking landings and skid trails

2.3. Estimating of area to be harvested

(a) Location and area of forest to be cut

Maps showing the location and areas of forest where harvesting has been approved in a management plan (expressed by compartments or sub-compartments) provide a sound basis for monitoring. Reliable maps showing the cruise location and the cutting plan must be available. Computer generated maps derived from a GIS would if available be helpful for this aspect of monitoring.

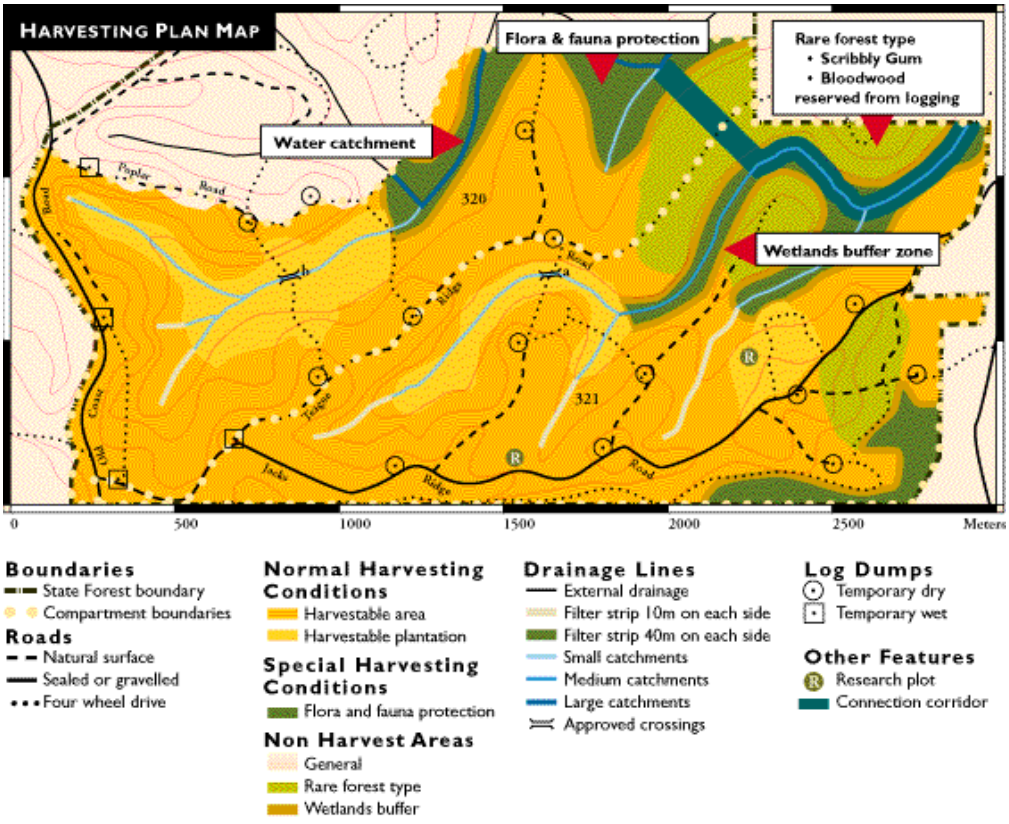


Figure 3. Example of a harvesting plan map, showing harvestable and non-harvestable areas and other features

Two approaches can be followed to estimate area to be harvested as follows:

Sampling: Monitoring to ensure that operational cutting is within a prescribed stems per hectare cutting range can be achieved through ground-based sampling in areas of forest selected at random and subsequently by making comparisons between prescriptions and monitoring data for the identical localities where logging has been undertaken.

Individual tree monitoring: A more intensive basis of monitoring can be achieved by comparing in the forest the stumps of each tree measured and numbered during cruising with the tree distribution map and the tree list that have been formed using cruising data. The tree list of numbered trees should be compared with the numbers of trees recorded

during the felling and log extraction. This approach provides the basis for a "chain-of-custody" record of trees to logs.

(b) Maximum stocking to be cut by forest types

Stocking is a quantitative measure of the area occupied by trees, usually measured in terms of well-spaced trees or basal area per hectare relative to an optimum or desired level of density. A desirable level of stocking is often considered that which maximizes timber production or other management objectives.

Stocking can be expressed in either absolute or relative terms.

Absolute terms: include the basal area or trees per acre.

Relative terms: measure the density against a reference level which is determined by dominant tree species, the plant community, and site index.

(c) Volumes by forest types comprising the annual cut:

The most critical aspect of log volume monitoring is check scaling of logs by a state forestry agency or other authority having responsibility for a forest management unit. Monitoring should be carried out at least monthly and should involve random checks on the accuracy of log measurements made and reported by a concessionaire or other agency that has operational responsibility for a forest.

Self-check 3	Written test

Name…… ID……

Date…….**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers

Test 2. Short Answer Questions

1. List what harvest plan should contain (3 points)
2. Write tasks may be distinguished during harvesting plan (3 points)

Score = _____
Rating: _____

Answer Sheet

Name: _____

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

Information sheet 4. Identifying mature trees and shrubs

4.1. Introduction

Specific trees are selected to be cut or left, based on their growth potential, ability to provide seed or wildlife benefits in the forest. This selection process takes into consideration numerous individual tree characteristics, not just tree size. Each tree to be cut is marked with paint to ensure that the prescription is followed.

The number of trees per hectare selected for harvesting will depend on:

- Tree marking rule
- Silvicultural system

4.2 Tree marking

Tree marking involves the careful selection of trees for harvest (under a partial cutting system), based on a forest management prescription. Trees may be marked to indicate a tree to be cut or left as per the forest management plan. Trees on forest boundary lines can be marked to indicate property ownership. Trees inside large forests can be permanently marked as part of a forest inventory system. Mark the cut trees in blue tree paint, or whatever color is used in that area. If you are worried about the wrong trees getting cut put a blob/dot of paint below the stump level in a crevice. Ground level is best for that mark. Then a higher mark at DBH is used so as trees can be seen.

Having your forest marked by a qualified tree marker is an important step that links your forest management prescription with the actual harvesting operations.

Here are some of the advantages of marking tree harvested:

- Tree marking identifies to the logger what is to be harvested and what is for sale;
- A qualified marker can mark your forest in a manner that will maintain a healthy forest and work towards ensuring that a new forest of desirable species grows after cutting.
- Not all trees are created equal and a small tree is not always a younger tree. Many of the small trees in your woodlot are small because of their age. However, the size of a tree may also be due to poor genetics, stunted growth or site characteristics. It takes years of experience to tell the difference, and an experienced tree marker can provide you with this expertise.

- Tree markers can identify the trees in the woodlot that should be retained to provide valuable wildlife habitat and to maintain biodiversity (e.g., cavity trees).
- Tree marking based on sound forest management principles will optimize your economic return and enhance future timber quality and quantity (to ensure a continuous and predictable supply of timber products and source of revenue)
- Tree marking done in conjunction with good forestry practices has the capacity to ensure the long-term sustainability of your forest

4.3. Silvicultural system

Silvicultural system is a planned program of silvicultural treatments designed to achieve specific stand structure characteristics to meet site objectives during the whole life of a stand.

These methods of forest tree harvesting selection include:

- ✓ Cutting limits
- ✓ Need for seed trees
- ✓ Tree developed for the particular forest type
- ✓ Stand condition.

Before felling operations commence harvesting company operations staff (including supervisors, tree marking staff and chainsaw operators) must:

- Have copies of tree marking rules and
- Understand how they are to be applied.

A silvicultural system generally has the following basic goals:

- Provides for the availability of many forest resources (not just timber) through spatial and temporal distribution.
- Produces planned harvests of forest products over the long term.
- Accommodates biological/ecological and economic concerns to ensure sustainability of resources.
- Provides for regeneration and planned seral stage development.
- Effectively uses growing space and productivity to produce desired goods, services, and conditions

Minimum standards for tree retention

Where desirable species are present in the sub-merchantable size categories:

- Identify protect and retain sufficient numbers of stems to ensure a viable residual stand
- Appropriate potential crop trees should be marked for retention or
- Silvicultural prescriptions approved by the Forest Authority should be applied.

Where desirable species do not exist in sufficient numbers, retain the original number and ensure that sufficient quality seed trees are preserved to provide for sustained regeneration.

Minimum standards for cutting

- Select only those trees that will provide logs suitable for processing.
- These must be of suitable species and have the minimum specified log length.

Choosing the trees to cut

Generally, there are four reasons foresters mark specific trees or harvest in any given timber sale.

1. Remove mature trees

Mature trees are those that have reached their maximum product value or the point where vigor, health, or growth are declining. Maturity doesn't relate very closely to tree diameter. For example a diseased, rough or suppressed 12 inch oak may be mature while a healthy 20 inch oak that is still increasing rapidly in value and volume may not be mature. This is why the saying, "cut the big ones and leave the small ones", doesn't work well.

Mature trees are important wildlife habitat and foresters may leave some of them to benefit wildlife. Old forests with dead and dying trees provide habitat for pileated woodpeckers and other birds which carve out holes and hollows of dead and dying trees for feeding, nesting and denning. Species that use these tree cavities include flying squirrels, owls, bluebirds, kestrels, chickadees and raccoons. Much of the economic value from a timber sale comes from cutting the mature trees.

Figure 4. Mature trees for cut

2. Improve the vigor and value of the stand remaining after the cutting

In any partial cutting one objective is to:

Remove the diseased, slow growing, and mature trees leaving crop trees that are increasing rapidly in size and value. The volume and value of good stems increase at a faster rate as tree diameter increases. Crop tree release is a valuable tool for improving wildlife habitat as well. Foresters will often release apple trees, oaks and other food producing species. Acorns are a staple for many of our forest wildlife (bear, deer, grouse, turkey, bluebirds, wood ducks and squirrels). The reproductive success of some wildlife species rises and falls with years of abundant and sparse acorn production.

Young immature trees grow much faster sometimes twice as fast when you remove the trees that interfere with them. But if too many trees are removed there aren't enough remaining trees to occupy the area and growth per acre lessens. Also, open-grown trees may sprout branches along the stem or retain their lower live limbs so that tree quality declines. That is why foresters are careful to keep stand density above a certain minimum (which varies with stand age and species composition).

3. Encourage regeneration (new seedlings) of desired species

A variety of regeneration cutting methods encourage seedlings of tolerant, intermediate, or intolerant species. For example clearcutting is used to favor regeneration of intolerants- paper birch, aspen, and pin cherry- along with a mixture of other species.

Some species have special seedbed needs for seed germination and early growth. For example disturbed soil or exposed subsoil helps yellow birch and white pine survive. These conditions can be created by well-distributed logging or with special equipment. Other species do best when competing shrubs, seedlings, and saplings are removed.

We try to regenerate species that are suited to the site, since certain species grow better in certain soils. We also try to grow species that will be valuable for timber and wildlife. The current stand condition influences what we try to regenerate. Also, most trees produce abundant seed only periodically and harvests are best timed to occur in a good seed year.

4. Meet certain requirements

These are trees used for income for the landowner (now or later), for wildlife habitat, for scenic values or to improve the logging chance (to help make the logging more salable). Trees are marked for timber, wildlife, scenic values, income, and to facilitate logging. General, foresters' use several silvicultural systems for regenerating, growing and harvesting trees. These include:

Clear cutting System

Clearcutting is best applied to stands where most of the trees are mature or defective and ready to be removed. It regenerates intolerant and intermediate species with some tolerant. As the new stand grows, you need to thin it to improve species quality, and growth. The later thinning remove products that can be sold. When the stand is mature (at the end of the rotation period) it may be clear cut again.

Clear cuts create habitat for a variety of wildlife not found in mature forests. Swallows, bluebirds and indigo buntings will quickly occupy a clear-cut particularly where snags or live trees with cavities and perches are left throughout. Raspberries, pin cherry, aspen, and paper birch sprout soon after cutting providing valuable sources of berries and seeds (mast), browse and cover for many species of wildlife. Black bear will forage throughout the summer on the edges of these cuts.

Figure 5. Pinus spp. clear cutting and it's log

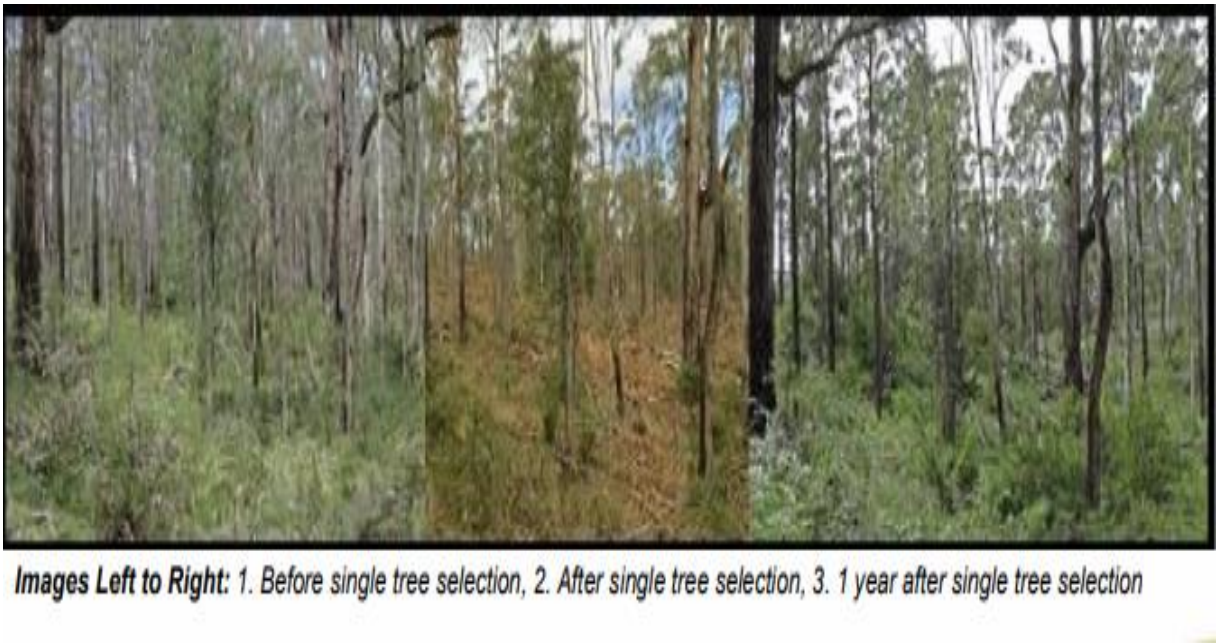
Shelter wood System

This system is applied in stands of mostly mature trees. The smaller trees are cut leaving an over story of larger trees to provide seed and shade for the new seedlings. If many over story trees are left, the shady conditions are good for tolerant species such as red spruce or hemlock. Fewer over story trees provide partial shade for oak or white pine. When an understory of desirable seedlings develops, the over story trees are carefully cut to prevent damage to the regeneration. The stand is thinned as needed over the rotation.

Figure 6. shelter wood cutting system

Single tree Selection System

Mature and low-quality trees are removed at each harvest. The system is best applied in stands that have a range in tree sizes and where the objective is to regenerate and grow tolerant species. After each cutting new tolerant seedlings develop and the stand always has the appearance of a well-stocked stand with a full range of tree sizes. As in any partial cutting care is needed to avoid logging damage to the remaining trees and regeneration. Diameter limit cutting is a type of single tree selection but is normally ill-advised since it ignores the vigor and value potential of individual trees regeneration needs and growing conditions around the remaining trees.



Images Left to Right: *1. Before single tree selection, 2. After single tree selection, 3. 1 year after single tree selection*

Figure 7. Single tree selection,

In single tree selection system, the trees are selected on the basis of diameter and condition, with smaller and younger trees retained to grow on to the next harvest and the old growth trees left for future species habitat. By selecting from the remaining competing trees, the retained trees have access to enough light, moisture and soil nutrients to respond and grow larger. To be selected for single tree selection harvesting, trees need to be aged between 60 and 120 years. Both good quality trees will be

removed for saw log and poorer quality mature trees will be removed to allow the younger trees to become the future saw logs.

Any remaining trees are either left behind as habitat trees or retained to continue to grow. When groups of trees are harvested during this process, the mechanical disturbance allows a seedbed for new seedlings to naturally establish. Single tree selection is used when the forest contains an uneven age class of trees, ranging from young regrowth trees to old growth habitat trees and everything in between. This method also seeks to retain this uneven age class for future single tree selection.

Group Selection System

This is a variety of single tree selection in which groups of trees about ¼ to ½ acre and larger are cut and single trees are removed between the groups. The system works best where the mature trees occur in clumps and where some mixture of intolerant or intermediate species is desired in the regeneration.

Group selection cuts maintain many of the bird species found in the mature forest. These cuts also create new habitat for some species that use clearings or regenerated stands (early successional habitat). Although not found in the mature forest, chestnut sided warblers, common yellow throats and white-throated sparrows will move into these small clearings, feeding on the abundance of insects. The buds, shoots, twigs, and leaves of new woody growth in these group cuts provide winter food for white-tailed deer, snowshoe hare, cottontails and beaver.

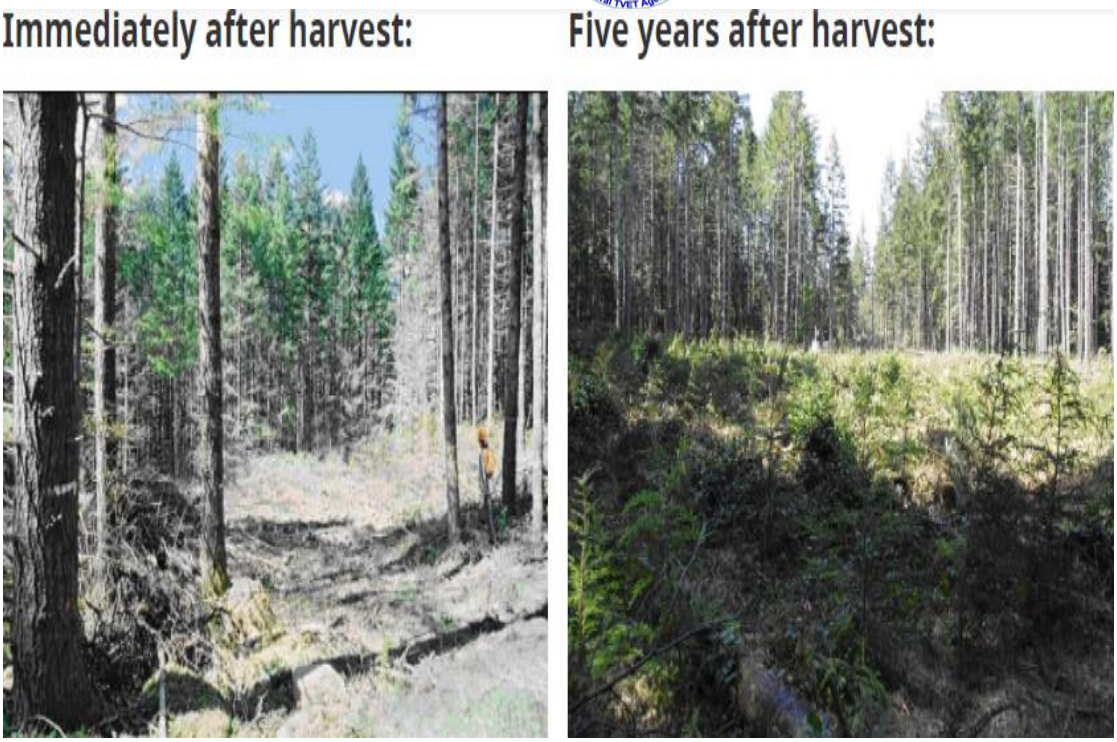


Figure 8. Harvesting trees based on group selection

Group selection silvicultural system removes small groups of trees from an area of up to a maximum of 0.5 ha. Over time the management area becomes a multi-aged mosaic of even-aged groups that eventually develops into an uneven-aged forest. The removal of small groups of trees minimizes the visual impact of harvesting but the resulting canopy openings may be too small to allow enough light for Douglas-fir to regenerate.

Self-check 4	Written test

Name…… ID……

Date…….**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers

Test 1. Chose part

1. The number of trees per hectare selected for harvesting will depend on (3 points)

A. Tree marking rule B. sivicultual system C. All

Test 2. Short Answer Questions

1. List methods of forest tree harvesting selection include (3 points)

Answer Sheet

Score = _____

Rating: _____

Name: _____

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

Information sheet 5. Allocating the required resource

5.1. Resource application

Resource allocation is the process of assigning and managing the required material which used for the activities in a manner that supports an organization's strategic goals. Access is required to real or appropriately simulated situations including:

- Materials
- Equipment
- Work areas
- Information etc.

Humans

- Chainsaw and machine operators that is well trained and skilled in the competencies of felling, extracting and loading of tropical timber.

Machines

- Chainsaws, skidders and loaders are correctly specified for the tree/log size in the forest; o Chainsaws are checked for operability prior to leaving the camp each morning and unserviceable saws are not sent to the forest; o Forest machines undergo a pre-startup inspection every morning and faults are addressed; o Daily targets are set for chainsaw operators, skidding machines operators and loader operators for the felling/crosscutting of trees, extracting tree lengths and loading of logs.

Materials:

- Operators are advised to closely monitor fuel consumption. A suggested ratio to measure fuel use by various equipment types is m3 of logs or km's of road per/liter.

Self-check 5	Written test

Name…… ID……

Date…….**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers

Test 1. Short Answer Questions

1. List resource required for forest harvesting (3 points)

Answer Sheet

Name: _____

Score = _____

Rating: _____

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

L #88	LO #2 Maintainng tools and equipment

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Establishing site workshops
- Maintaining harvesting tools and equipment
- Training technicians for harvesting

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

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- Maintain harvesting tools and equipment
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Information sheet 1. Establishing site workshops

Workshops

A home workshop is a cool place to have. However, your home workshop won't be efficient if you don't have the best tool in it. There are a number of tools that your home workshop should be equipped with. Workshops shall be constructed according to the specifications set out in the approved ESIA prepared for the company. .

- Workshops shall be located at least 100 m away from any watercourse or water body on a stable surface
- Hydrocarbon (fuel and oil) storage shall include bunding as shown in Figure 9 below. The bund wall shall allow for containment of at least the contents of the largest tank within the bunded area.
- The bund wall shall allow for containment of at least the contents of the largest tank within the bunded area
- Waste management shall be dealt

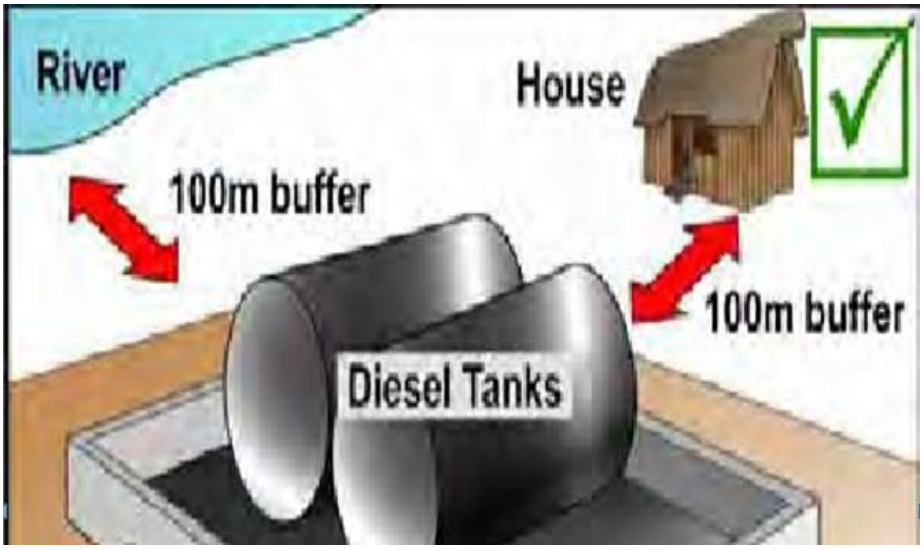


Figure 10. Work shop for tools and equipment

Waste management

Waste management shall be dealt with according to the specifications set out in the approved ESIA prepared for the company.

- Hazardous waste (hydrocarbons, batteries and fluorescent tubes/bulbs) shall be specifically addressed in the waste management plan
- Waste pits shall be used for non-hazardous inorganic waste disposal (e.g. plastic, metal, glass)
- Waste pits should be used for organic waste disposal (food waste and paper);
- Waste pits should be burnt out from time to time to prolong their useful life.
- Waste pits shall be located at least 100 meters from any water body and at least 1m
- The area should be fenced off and signs should be erected identifying waste pits;
- Waste pits should be covered with at least one (1) m of soil once they reach the end of their useful life;
- Toxic materials shall never be disposed of into watercourses or lakes

Self-check 1	Written test

Name…… ID……

Date…….**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers

Test 1I: Short Answer Questions

1. List methods of waste management as ESIA prepared for the company (3points).

You can ask you teacher for the copy of the correct answers.

Score = _____
Rating: _____

Answer Sheet

Name: _____

Note: **Satisfactory rating - 15 points** **Unsatisfactory - below 15 points**

Information sheet 2. Maintaining harvesting tools and equipment

Harvesting tools and equipment are all hand tools, camp equipment, drawing materials and survey instruments used to officers personally for use in carrying out forest harvest operation activities. All basic hand tools for logging should be maintained regularly for efficient operation of the harvesting activities.

2.1. Tools used in logging operation and their maintenance

The main characters which are desired in forest harvesting tools include:

- Strength
- Durability
- Efficient

The basic work and maintenance tools are:

- Axe
- Saws
- One man saw
- Cross cut saws (two man saw
- Chain saw
- Machete
- Bow saw
- Meter tape
- Cross cut saw etc.

A. Axes29

Purpose of using axes:

- Felling
- Trimming
- Splitting
- Grubbing

I. Felling axe:

Axes consist of 2 parts i.e. iron head and wooden handle. The axe head carries a socket (eye), into which the handle fits. The portion of the iron head in front of the eye is known as the blade and portion behind the eye is known as back.

Axe head

Consist of cutting edge and body with an eye in it. Axe head is either solid piece of iron with still wedge welted into it or two tapering pieces of iron between which narrow wedge of steel is introduced. Edge should be sharp, of proper temper, neither too soft as it will bend, nor too brittle, causing it to chip. The side should be slightly convex and proportionate to enter the wood easily. The edge of the blade should be slightly curved for better penetration, renders the corners liable to break off. The weight of the head varied with type of the timber to be cut and work to be done. Generally they weigh 1.5-2 kg or more for larger trees.

To increase efficiency and ease of work correct grinding of axes, to sharpen them is necessary.

Axe handle

- Round handles fitting in round eyes mostly used
- Advantage ---easy made and fitted
- It can be easily replaced on the spot by cutting a solid bamboo or a straight piece of tough wood.
- Disadvantage –liable to slip round the eye
- American and European use oval shaped handles to avoid slip round the eye and provide better grip

II. Trimming axe

Used for the cutting of branches of fallen trees and for rough squaring timber. For the former purpose blade is broader (25-30 cm) while for the latter. Broad heavy axe (2.5-3 kg) or may be as heavy as 4.5 kg is used having long handles.

III. Splitting axe

Used for splitting round logs longitudinally. Should not be very sharp but should be heavy. Blade should have sufficient taper and weight should be peripherally distributed round the eye to give axes the requisite driving power.

IV. Grubbing axe

Grubbing axe intended for digging round and cutting through the root of the trees. The blade should be 30 cm long, narrow and slightly curved cutting edge 5-10 cm broad.

Figure 11. The parts of an axe

12 Axe Parts and Their Descriptions

- **Head** – the entire V-shaped cutting portion of the axe usually made of steel and attached to a handle
- **Bit** – the cutting edge of the axe head; axes can be single bit, meaning they have one cutting edge, or double bit, meaning they have two cutting edges
- **Toe of the bit** – the very top of the bit or cutting edge when holding the axe in a natural cutting position
- **Heel of the bit** – the very bottom of the bit or cutting edge when holding the axe in a natural cutting position
- **Eye** – the top of the head where the handle can be seen
- **Cheek** – the side of the axe head

- **Beard** – the concave portion of the bottom of the axe bit near the handle; beards can very shallow, deep, or in between
- **Handle** – the entire portion of where the axe is held
- **Body of the handle** – typically near the center of the handle where your upper most hand would hold it
- **Back of handle** – the entire back of the handle
- **Throat of the handle** – typically near the bottle of the handle where the bottom hand would hold it
- **Knob** – the very bottom of the handle that flares out to prevent the axe from slipping out of your hands

Most axes share many of the same parts. They have a head and handle with many small parts in between. Although they share all these parts, the variety of the parts, such as the shape for the head and the design of the bit, determines what type of axe it is and what it should be used for.

B. Saws

- Saws are used for felling, conversion i.e. cross cutting, ripping log into scantling, sleepers and other classes of converted material
- Cheap, simple to handle and easy to maintain
- Power chain saw expensive, speed of out-put is much more
- Saws are called
  - ✓ One man or
  - ✓ Two men saw according to worked by one or two man.

The terms used in connection with saw

Face: The edge of tooth which facing the cutting direction

Back: The opposite edge of the tooth

Space: distance from tooth to tooth

Gullet: The entire opening between two adjacent teeth

Pitch: The angle between the face of a tooth and the line passing through the points of the tooth

Set: The extent to which the teeth are bent to either side of the plane of the blade

Kerf: The width of the saw cut

Gauge: The thickness of the blade

C. Cross cut saws (two man saw)

- Used for felling of trees and conversion into logs

Length

- Cross cut saw of following lengths are used

Length of saw	Diameter of stem
140-150 cm	30 cm
165-170 cm	30-70 cm
180-200 cm	80-100 cm and over

Breadth

Narrow felling saws give lesser friction in the cuts than the broad ones. In case of narrow blades, wedges can be driven into cuts at an early stage thus reducing the jamming. The saw with width of 85 mm along whole length or 90 mm at the ends and 120 mm in the middle, have proved to be best.

Thickness

Strength of the blade is influenced by its thickness. Saws which are too thick lead to a broad kerf (cut) and require large energy for sawing. For saws 80 mm broad and 165 cm length a thickness of about 1.82 mm has proved quite suitable.

Tooth shape

The teeth have to perform three different tasks in cutting

- Cut of the fibers
- To break of the fibers that have been cut
- To carry away the fibers or saw dust out of the kerf

Kinds of saw used for felling and cross cuttings

- Peg tooth saw (triangular saw)
- The raker saw
- M-tooth saw

I. Peg tooth saw

Teeth similar to one another and is triangular in form. The points and edges of the teeth cut and loosen the wood fibers and saw dust is pushed out through their gullets.

II. Raker tooth saw

Generally has one raker tooth following every two cutting teeth. May be four cutting teeth and raker tooth. The cutters cut the wood fibers along both sides of the grove each

group of cutter is followed by a raker tooth which working like a chisel, break off the fibers and carries them out of the saw kerf. Better cutting than M tooth saw.

III. M tooth saw: Similar to peg tooth but teeth are M in shape

There may be number of types of saw in the market but differ in size, shape, weight, number of teeth and other minor details.

D. One man saw

Bow saw: Used for the felling of small trees and poles and other small sized products. The bow saw is the most important. It is a saw with a frame and thin and narrow saw blade. Blades of 90-105 cm size are used. Cutting depth is 25-30 cm. For larger log cutting can be done by both side. Used for felling, sawing, clearing, thinning, cutting of fence posts, fire wood.

Pruning saw used for:

- Cutting of branches on growing trees
- Clearing stems
- Secure high quality knot free timber pruning is generally done by it.

Maintenance of saw

The reason for maintain saw is:

- To increase the efficiency of the work
- To increase cutting capacity

If upkeep is neglected output decreases, energy requirement goes up, increasing waste of time and loss of wages.

How to maintain saw?

The saws in the forest are open to influence of moisture and weather. The rusty color does disappear during use but depressions remain. They cause greater friction and require a bigger effort. The saws should be stored in dry places in order to prevent rusting of saw blades. Rubbing with oil provide adequate protection.

E. Chainsaw

The chainsaw is for cutting the big lumbers. It will cut large wood pieces of wood including trees easily. It is a mechanically powered handheld saw.

The saw incorporates a set of teeth along a moving chain. The chain moves by rotating around a steel panel as you cut your wood.

As the chain rotates, it slices through the wood with very high power and an even greater force. Most of these saws use the gasoline engine to power the chain that has the teeth.

Some chainsaw models are also driven by an electric motor. However, the model that uses the engine option will offer greater power.

Figure 12. Chainsaw and its part

E. Power saws

They are generally one man operated. Power is generally supplied by engine attached to the machine. Most of the saws are carried from tree to tree by hand.

Advantage of power saws

- Greater volume production per unit of time than manual labor (time saving)
- Light weight for easy portability
- Less breakage in felling
- Easy to replace, sharpen
- Can be used for sawing horizontally and vertically

Disadvantage

- Dense undergrowth makes it exceedingly slow and expensive to move power saw from tree to tree.
- Labor is not generally accustomed to their use, adjustment and repair.
- The saw require constant attention, replacement of parts and sharpening. In remote areas repairs and parts cannot be readily secured.
- Fellers are not generally good mechanics

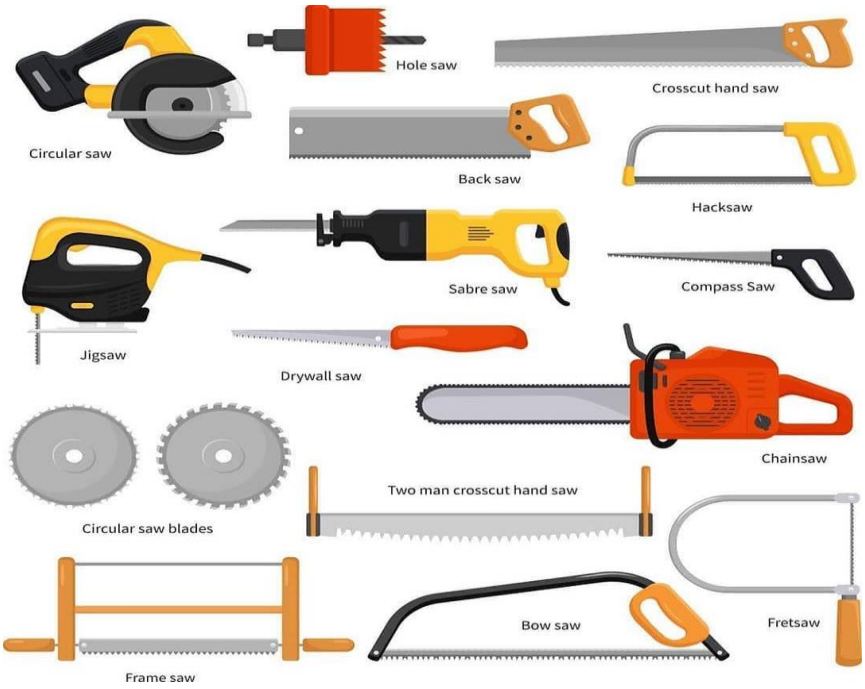


Figure 13 Different type of saw

Miscellaneous tools

Wedges: Use in felling trees and to prevent jamming of the saw in cross cutting and for longitudinal splitting. Metal wedges are made of steel or iron and are generally up to 30 cm long, 8 cm wide and weigh up to 5 kg. Wooden wedges with iron band are also used. The felling wedges have a much sharper angle.

Cant hook: Used as liver in rolling, stopping and turning logs.

Cant Hook (log jacks): Used as liver in rolling, stopping, turning logs.

Pickaroons: Short poles 85-100 cm long, with a recurved hook, for drawing or pulling small logs.

Debarking spade: Spade with a bent blade which is used for debarking logs.

Measuring stick: Used for measuring log lengths, which has marking ends?

Log Hook: Used for dragging, lifting and rolling

Stem tighter: To prevent the splitting of stem at the butt end.

Self-check 2	Written test

Name…… ID……

Date…….**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers

Test 1. Short Answer Questions

1. The main characters which are desired in forest harvesting tools include (3 points)

A.Strength

B. Durability

C. Efficient

D. All

Test 2. Short Answer Questions

1. Lis the basic work and maintenance tools methods (3 points)

Answer Sheet

Name: _____

Score = _____

Rating: _____

Note: **Satisfactory rating - 10 points** **Unsatisfactory - below 10 points**

Information sheet 3. Training technicians for harvesting

Training technicians for forest harvesting work in training programs and apply a practical understanding of the training program and its objectives, policies, procedures, and requirements. ... For example, a training technician may be responsible for the planning, direction and administration of the testing program for a training center.

Training and education of industry personnel are critical in any strategy to improve forest-harvesting practices. In forest harvesting activities only fully qualified forestry workers (including machine operators) should participate in salvaging operations. Formal basic training of forest workers should fully cover logging in damaged forests. Where on-the-job training is used, it should be included only after trainees master the basic training. Regular up-dating training should be given. At least once every third year is recommended. The number of trainees should not exceed 6 in each group to achieve efficient training. Forest harvesters or technician has to be fully trained on the required forest harvest activities.

Important skill required and qualifications gained through training include:

- **Communication skill**
  - ✓ Complete health, safety and environment, hazard, environmental and incident reports according to workplace procedures and state or territory legislation
  - ✓ Establish and maintain communication with others according to occupational health and safety requirements
  - ✓ Prepare reports to supervisors in a timely manner, presenting all relevant facts according to established organizational procedures
  - ✓ Record and report quality and product care procedures according to workplace procedures
- **Team work**
  - ✓ Seek first aid assistance from others in a timely manner
  - ✓ Share relevant workplace information with co-workers to achieve designated individual and team goals and objectives
  - ✓ Support team members in meeting expected outcomes
- Problem solving

- ✓ Participate in workplace meetings using agreed processes to resolve issues
- ✓ Assess and rectify problems to avoid repetition of lost product within limits of own role
- ✓ Monitor environmental measures and impact on the environment and take corrective action as required according to workplace procedures
- ✓ Plan product recovery to optimize resource value and minimize waste

- **Planning and organizing**
  - ✓ Gather, convey and receive information
  - ✓ Identify and assess organizational environmental goals
  - ✓ Plan evaluation processes according to site procedures
  - ✓ Identify, review and interpret work requirements
- **Technology**
  - ✓ Monitor equipment conditions for overheating and electrical sparking and respond according to workplace procedures
  - ✓ Check equipment to ensure it is serviceable for emergencies

Safety in forest work is not simply a matter of using correct work practice or protective clothing. Safety must be an integral part of the whole operation. Safer work requires well defined working methods and organization, and adequate tools and equipment. New and innovative methods and techniques are often introduced. Special safety regulations must be implemented because of the specific risks involved in harvesting damaged forests. This involves identifying the risks and developing well defined working methods which minimize these risks. Training must be given in the correct techniques and suitable equipment and protective clothing must be used.

On-site refresher training: When acute forest damage has occurred the qualified forest worker should be given on-site refresher training. This should if possible be in representative stands which may also be used as models for work organization and productivity. One day (morning theory, afternoon practice) may be sufficient for refresher training. In emergency situations it is often necessary to recruit additional workers who may be employed directly or through contractors. Such workers should have received introductory training and shown that they are able to work safely on the jobs assigned to them.

Supervisors and team leaders are key people. It is essential that they have an awareness and knowledge of safety matters. Supervisors/team leaders must ensure that safe methods and equipment are used. They need basic training in safe methods and techniques and should also receive refresher training when involved in large salvaging operations.

Training of forest operators primarily involved:

- Road construction and maintenance
- Tree felling
- Log extraction
- Processing.

There was extensive consultation with industry to determine the most appropriate training programs.

Self-check 3	Written test

Name…… ID……

Date…….**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers

Test 1I: Short Answer Questions

1. Write important skill and qualifications required for the workers gained through training include (3points).

You can ask you teacher for the copy of the correct answers.

Score = _____
Rating: _____

Answer Sheet

Name: _____

Note: **Satisfactory rating - 15 points** **Unsatisfactory - below 15 points**

Operation Sheet 1	Maintaining tools and equipment

Objective: To increase the life span of basic hand tools (axe) and increases the efficiency of logging operation

Materials, tools and equipment required:

- File
- File card
- Gloves
- Stones
- Clamp or vise
- Work bench or table

Procedure:

1. Wear safety cloths
2. Collect all tools, materials and equipment used.
3. Assess the damage to the cutting edge
4. Place a wooden wedge under head to lift the bit away from the table, as well as to add stability.
5. Clamp the axe to your table/bench.
6. Use a black permanent marker and draw along the edge of the blade. Usually mark about 1/2” behind the cutting edge if it is already properly profiled.
7. Holding the file at an angle, push the file across the bit of the axe away from the cutting edge (towards the poll on a single bit axe).
8. I start closer to the cutting edge (primary bevel) this time, holding my file around 20-25 degrees.
9. Turn the axe back over to the original side, and hold your file a little shallower.
10. Turn the axe over again, and file the remaining bit of the axe.
11. Test the edge. A truly sharp edge is one that will dry shave the hair off your arm.

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 2 hour.

Task 1- Maintaining axe sharpening, regrind or re-profile

L #89	LO #3 Follow appropriate harvesting procedures

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Considering eeconomic feasibility and environmental issue
- Clearing stump site
- Determining felling direction
- Felling trees in prescribe direction
- Debarking and cross-cutting felled trees
- Transporting logs to storage site

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Consider eeconomic feasibility and environmental issue
- Clear stump site
- Determine felling direction
- Fell trees in prescribe direction
- Debark and cross-cut felled trees
- Transport logs to storage site

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.
2. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
3. Accomplish the “Self-checks” which are placed following all information sheets.
4. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
5. If you earned a satisfactory evaluation proceed to “Operation sheets
6. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,

7. If your performance is satisfactory proceed to the next learning guide,
8. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information sheet 1. Considering economic feasibility and environmental issue

1.1. Introduction

Forest harvesting must be well planned and organized in order to make the best use of the raw material for economic values, while keeping labor input and production cost low and minimizing damage to the environment. Forest-harvesting plans must incorporate measures that protect a number of other values. Like environmental protections, these vary across the country but there are some common like Heritage sites, historical place and park land area.

Improved and new forest operations systems and technologies help to:

- better create and protect wildlife habitat,
- harvest trees on seasonally wet lands,
- reduce erosion and stream sedimentation from forest roads,
- maintain soil and site productivity,
- elevate aesthetics of future forest activities through computer-aided visualization,
- prevent and manage major fire or insect and disease outbreaks by thinning unnaturally dense forests, and
- Rehabilitate and restore forest and range health, productivity, and function.

1.2. Environmental considerations

The ability of soil to supply plants with nutrients is a critical aspect of site capability. In large part this ecological function depends on the nutrient capital of a site, which is the amount of nutrients present in the soil, living vegetation and dead organic matter. When trees are harvested the nutrients in their biomass are also removed which can deplete the nutrient capital of the site.

1.2.1. Forest Harvesting and Site Capability

A stand of forest may be harvested using a variety of methods, which vary in the amount of biomass and nutrients that are removed from the site. A selection harvest is a relatively “soft” method because it involves the harvesting of only some of the trees from a stand leaving others behind and the structure of the forest substantially intact. The most intensive harvest is a clear-cut in which all economically useful trees are removed. The smallest clear-cuts typically involving a hectare or less are known as a group-

selection harvest. More typically, clear-cuts entail the harvesting of trees from larger areas on the order of 20-100 ha. The largest clear-cuts may extend over hundreds, and even thousands of hectares. However, such extensive operations are unusual and are usually associated with the salvaging of trees that have been damaged by a wildfire, windstorm or insect infestation.

Figure 14. shelter wood cut of hardwood forest in Nova Scotia.

Source: B. Freedman

This photo shows a three-year-old shelter wood cut of hardwood forest in Nova Scotia. About 60% of the trees were removed during the harvest but many of the “best” trees were left to grow into high-quality saw logs and to shed seeds to promote regeneration. This treatment produces a complex habitat that supports a mixture of birds and other wildlife typical of both clear-cuts and mature forest.

1.2.2. Nutrient Losses during Harvesting

Although intensive harvests such as a whole-tree clear-cut increases the yield of biomass, there is also considerably more removal of nutrients. Some forest scientists have suggested that the nutrient removals from whole-tree harvests could degrade the capability of sites to sustain tree productivity. The problem would be especially severe if the harvests are conducted over a short rotation. This might not allow enough time for the nutrient capital to recover by natural inputs such as by precipitation, nitrogen fixation, and weathering of minerals

1.2.3. Leaching of Nutrients

The disturbance of forested land can increase the rate at which dissolved nutrients are transported downward into the soil with percolating rainwater (a process known as leaching). If the nutrients leach deeper into the soil than tree roots can penetrate, they are effectively lost from the “working” nutrient capital of the site. Eventually, leached nutrients can find their way into groundwater and surface waters.

The nutrients with the greatest tendency to leach are nitrate and potassium, both of which are highly soluble in water. However, calcium, magnesium, and sulphate may also leach in significant amounts. Of course, following a clear-cut, any nutrient losses by leaching are in addition to that removed with tree biomass.

1.2.4. Forestry and Erosion

Forestry activities can cause severe losses of soil, or erosion, particularly in terrain with steep slopes. In most cases, erosion is triggered by improperly constructing logging roads, using streams as trails to haul logs, running log-removal trails down slopes instead of along them, and harvesting trees from steep slopes that are extremely vulnerable to soil loss. In general, however, road building is the most important cause of erosion on forestry lands, especially where culverts (channelled stream crossings) are not sufficiently large or numerous, or are poorly installed.

Practices that help to reduce erosion during forest harvesting include:

- Planning the route of forest roads to avoid stream crossings as much as possible
- Installing a sufficient number of properly sized culverts
- Avoiding the disturbance of stream channels by heavy equipment
- Leaving buffer strips of uncut forest beside watercourses
- Using log-removal practices that avoid disturbance of the forest floor (such as cable yarding, in which a tall spar anchors cables radiating into the clear-cut, which allows logs to be dragged to a central place without the use of a wheeled skidder)
- Allowing vegetation to regenerate quickly, which speeds the re-establishment of biological moderation of erosion
- Deciding to selectively harvest, or to not harvest, steep sites that are highly vulnerable to erosion

1.2.5 Forestry and Biodiversity

Clear-cutting and other forestry practices inflict intense disturbances on forests. They cause dramatic changes in the habitat available to support:

- Plants,
- Animals and
- Microbes, as well as their various communities. Some species benefit from habitat changes that occur because of forestry, but others suffer damage.

1.2.6. Freshwater Biota

Forestry practices can degrade freshwater habitats in four major ways:

- By siltation (the settling of soil eroded from the land and streambanks)
- By increases in water temperature caused by the removal of shading vegetation from stream edges
- By blocking stream channels with logging debris
- By changes in hydrology

1.3. Economic feasibility

The future forest depends on your management decisions. Any decision to harvest timber requires careful planning, and you should compare alternative harvesting methods before you begin. Sustainable forestry harvesting encompasses:

- Social
- Ethical
- Ecological and
- Economic factors.

Socially sustainable forestry takes into account human activities such as forest jobs, forest recreation, and community involvement. Economically sustainable forestry should provide landowners with enough income to cover their costs and keep the forest a forest. By applying principles of sustainable forestry in their management activities--particularly timber harvesting--landowners can derive personal benefits while maintaining forests that are an asset to society. The key element in making sustainable forestry feasible is its affordability to the landowner. The following cost-benefit analysis will show the short and long term economic results of two different harvesting methods.

Self-check 1	Written test

Name…… ID……

Date…….**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers

Test 1. Short Answer Questions

1. List the criteria that included under sustainable forestry harvesting (3 points)

Score = _____
Rating: _____

Answer Sheet

Name: _____

Note: **Satisfactory rating - 3 points** **Unsatisfactory – below3 points**

Improved and new forest operations systems and technologies help

Information sheet 2. Clearing stump site

Clear stamp site is crucial for felling should be viewed as wood transport where the first few and most expensive meters matter. Facilitation of extraction is therefore a primary concern. Felling should further not cause damage to logs. Damage to residual stand should also be taken into account. Trees are felled manually using axes, cross cut saws or bow saws. Some delimbing is done using axes and machetes. The bow saw has largely replaced the cross cut saw for trees up to 30 cm in diameter. Most felling in forestry is done by chainsaws today.

The benefit of clearing work site used for:

- Ensure that no other person is within the felling danger zone of at least two tree lengths radius from the tree to be felled.
- The danger zone is 360° around the tree to be felled.
- Determine an appropriate escape route.
- Normally 45° away from the felling direction.
- Ensure the escape route is open and clear of obstacles. The following schematic drawing shows the danger zone and the escape route around the tree to be felled

Application of felling rules and stamp clearing site

Step 1: Cleaning of boundary around the tree

Step II: Decision on proper direction of felling depending on factors such as wind, tree lean, crown overhang, strip road location, risk of hang ups, etc.

Step III: Debarking at the intended saw cut as the bark is normally contaminated with saw and clay

Step IV: Sawing the sink starting with the upper cut (for small tree axe may be used)

Step V: Sawing the felling cut at the same level as the undercut or slightly above

Step VI: If necessary pushing or using wedge to bring the tree to fall in the planned direction. When the trees start to fall, the cutters should move to a safe position behind the tree to avoid injury from kickback or sliding of the butt.

Self-check 2	Written test

Name…… ID……

Date…….**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers

Test 1. Short Answer Questions

1. List the advantage of clearing stamp work site (5 points)
2. List the step following during tree felling and stamp clear site (5 points)

Score = _____
Rating: _____

Answer Sheet

Name: _____

Note: **Satisfactory rating - 5 points** **Unsatisfactory – below 5 points**

Information sheet 3. Determining felling direction

The tree felling direction must be carefully determined.

This will depend on:

- the skidding direction
- the lean of the tree
- the shape of the crown
- the wind direction
- obstacles in the way of the tree's fall
- Obstacles on the ground and also on the possibility of retreating safely.

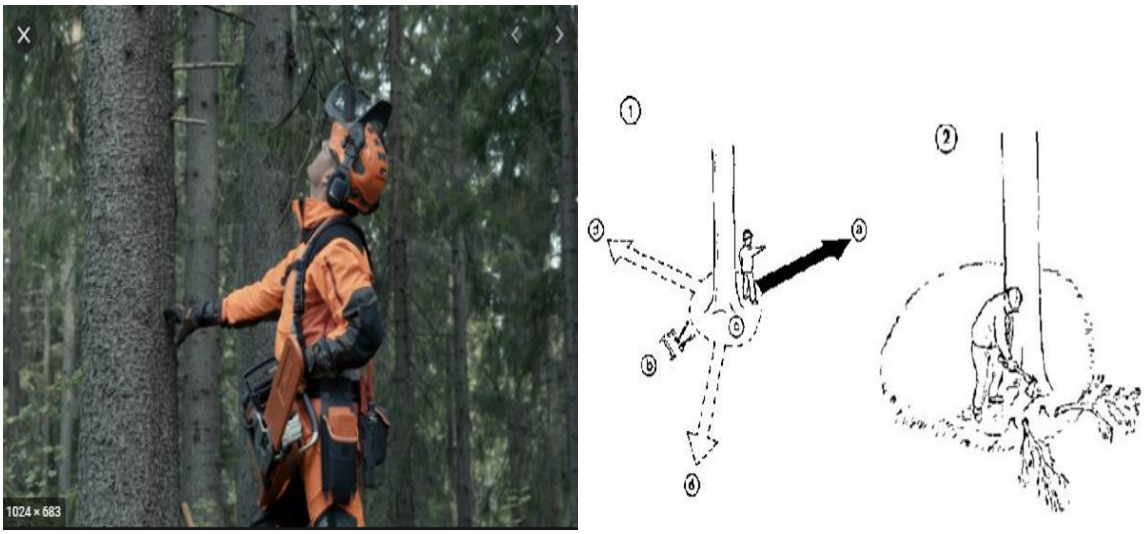


Figure 15. Determine tree felling direction and clear escape route

The felling direction must be carefully determined (1). This will depend on the skidding direction, the lean of the tree, the shape of the crown, the wind, and on obstacles in the way of the tree's fall obstacles on the ground and also on the possibility of retreating safely. When the felling direction (1a) is determined, the tools are placed opposite to the felling direction, behind the tree (1b). The working area around the tree is cleared (1c). Two escape routes are cleared, as far as it is necessary to allow easy retreat, placed sideways at about 45 angles to the rear (1d). The base of the tree must be well cleared, using the axe or a matched in order to prevent the saw from blunting too quickly (2).

Self-check 3	Written test

Name…… ID……

Date…….**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers

Test 1. Short Answer Questions

1. How we determine the tree felling direction (5 points)

Score = _____
Rating: _____

Answer Sheet

Name: _____

Note: **Satisfactory rating - 5 points** **Unsatisfactory – below 5 points**

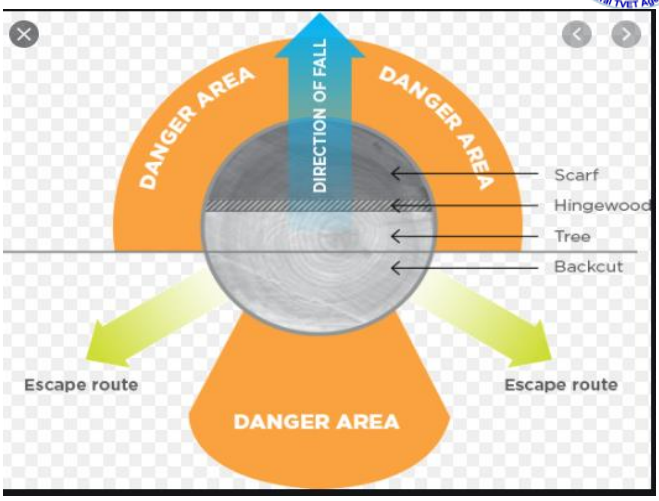
.

Information sheet 4. Felling trees in prescribe direction

Felling should be viewed as wood transport where the first few and most expensive meters matter. Facilitation of extraction is therefore a primary concern. Felling should further not cause damage to logs. Damage to residual stand should also be taken into account. Trees are felled manually using axes, cross cut saws or bow saws. Some delimbing is done using axes and machetes.

Felling technique

- Ensure that no other person is within the felling danger zone of at least two tree lengths radius from the tree to be felled.
- The danger zone is 360° around the tree to be felled.
- Determine an appropriate escape route. Normally 45° away from the felling directi on.
- Ensure the escape route is open and clear of obstacles. The following schematic drawing shows the danger zone and the escape route around the tree to be felled (seeFigure 17)



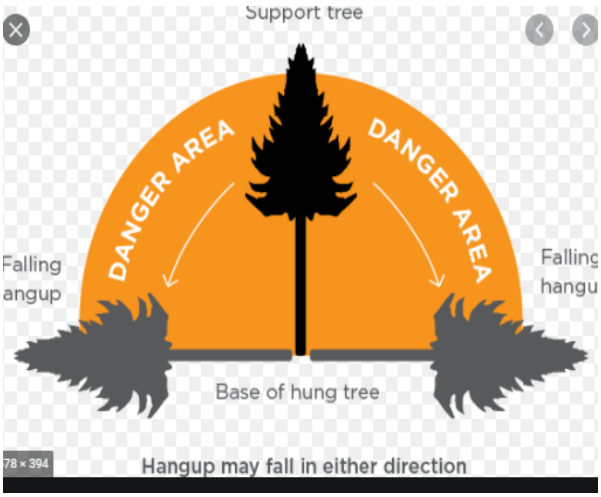


Figure 16Schematic representation of felling danger zone felling hung up tree.

Check the possible felling direction by taking into account the following:

- the angle at which the tree is leaning;
- crown size and overhang;
- neighboring trees;
- wind direction;
- planned extraction direction;
- slope on which the tree is growing;
- environmental considerations;
- silvicultural requirements.

Fell the tree using the following three cuts:

- directional notch (top cut);

- directional notch (undercut) - angle to be at least 45°;
- Felling cut. The tree is steered in the desire

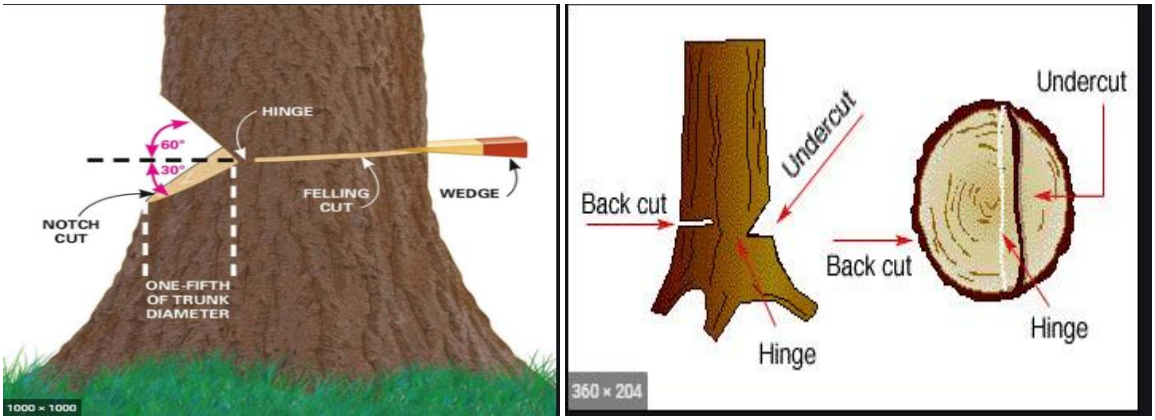


Figure 17. Three cuts

4.1. Felling principles

Two main principles underlying the methods of felling

- The production of maximum amount of sound timber that can be made available for export from the forest
- The avoidance of damage to the surrounding forest

4.2. Felling rules

- Trees should be felled as near the ground as possible
- Tree should be felled in a manner and in a direction in which they do least
- damage to themselves
- Tree should not be felled such that they fell into the place where it is not possible to convert or extract the timber
- Tree should not be felled during a strong wind
- Felling should usually begin at the top of the slope and proceed in a downhill directions
- Felling should be concentrated as much as possible

Felling can be roughly classified as:

- Uncontrolled felling
- Semi-controlled felling
- Controlled/organised felling
- Directional felling
- High-tech felling

Uncontrolled felling: No attempt to influence the direction a tree falls; safety precautions and sound working techniques are disregarded.

Figure 18. Uncontrolled tree felling

Semi-controlled felling: Fellers have a fair idea where a tree will fall but do not influence the lay. Basic rules are observed e.g. rudimentary cutting of felling notches and back cuts.

Controlled/organized felling: Scarfs are well-executed, back cuts are well placed and hinges in accordance with desired felling directions.

Directional felling: Fellers are fully capable of felling trees in the direction desired, which may deviate considerably from the natural lean. Operational and silvicultural aspects are taken into account. Additional tools like wedges and winches are used.

High-tech felling: Fully mechanized felling using feller-bunchers or harvesters, and techniques/machines in development. Generally; high-tech felling is not feasible for large trees. Skills needed to perform organized or directional felling must be learnt on ground preferably under supervision of professional instructors. Guidelines for “typical cases” are available, e.g. trees with or without lean, with or without buttresses, according to lean 45^{o} or 90^{o} to the direction of the lean. In reality however, there is only “unique cases”.

Figure 19. Feller-bunchers

4.3. Methods of felling

- Felling with axe alone
- Felling with saw alone
- Felling with axe and saw combined
- Felling with fully mechanized machine

i) Felling with axe alone

- Under cut given in the direction of tree to fall (2/3 dm of dm of tree)
- Under cut may extend to 3/4th for bigger tree

ii) Felling with saw alone

- Begins side opposite to intended fall
- As cutting proceeds wedges are driven to prevent saw from sticking, jamming and to guide the falling of tree

iii) Felling with axe and saw combined

- First step is to cut by axe 1/5th or 1/4th of dm of stem in the direction of intended fall
- Saw cut is made in opposite side and continued to meet axe cut . wedges are driven as the sawing proceeds
- IV. Felling with fully mechanized machine

A feller buncher is a type of harvester used in logging. It is a motorized vehicle with an attachment that can rapidly gather and cut a tree before felling it. Feller is a

traditional name for someone who cuts down trees, and bunching is the skidding and assembly of two or more trees.

4.4. Felling of difficult trees

Difficulties may be:

- Leaning trees or tree with heavy overhang
- Tree with centre rot
- Tree with buttresses
  - ✓ Make considerable deeper sink (may be more wood loss at but end) to prevent splitting at valuable butt log or Or saw two additional undercuts from the side after that felling cut can be sawn as usual
  - ✓ Felling cut must be closely observed since holding wood may break rapidly or suddenly

Felling trees against the lean

- Often quite large force must be applied to compensate for the overload and bring the tree to fall in another direction.

4.5. Safety rules in tree felling

- Always have an escape route for use in the event of the tree unexpectedly following opposite direction
- Felling should be done systematically, one step at a time, taking necessary precaution
- The safety distance between two working teams must be, not less than two tree lengths of the tallest trees due to the risk of over felling

Factors could influence felling productivity

The following factors could influence felling productivity:

- safety considerations;
- tree size;
- tree diameter;
- escapement;
- terrain;
- tree species;
- debarking percentage (where applicable);

- stem form;
- crown shape and size;
- lean of the tree;
- felling direction;
- undergrowth;
- serviceability and suitability of equipment;
- operator skills;
- cutter working alone or with an assistant;
- subsequent operations to be completed by the operator and assistant (where applicable);
- environmental considerations

Self-check 4	Written test

Name…… ID……

Date…….**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers

Test 1. Choose part

1. From the following which one is not methods of felling trees (2 points

A. felling tree with axe B. Felling trees with saw c. felling trees with axe and saw

D. all

Test 1. Short Answer Questions

1. **What are felling rules and how we perform felling tree(5 points)**

Score = _____

Rating: _____

Answer Sheet

Name: _____

Note: **Satisfactory rating - 10 points** **Unsatisfactory – below 10 points**

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Information sheet 5. Debarking and cross-cutting felled trees

5.1. Debarking

Debarking is the process of removing the bark from species after tree felled. This can be done by:

- Manually or
- Mechanically

5.1.1. Manual debarking

Manual debarking is normally performed with a sharpened hatchet. The bark is detached either as long or short strips or small plates. As far as possible, effort should be made to ensure that logs are free of cambium. Debarking spuds (hoe type piece of equipment) and shaped spades can also be used to debark. Either tree lengths or logs can be debarked.

The following is seen as the minimum protective clothing that must be worn by manualde barkers:

- Overalls
- Hard hat
- Safety boots
- Leg protectors
- Rubber gloves
- Eye protection

Manual debarking is a strenuous job with an awkward posture and debarkers must be trained in the correct debarking techniques.

Debarkers must take note of the following:

- Always debark on the far side of the log away from feet and legs.
- Always use a properly maintained debarking tool.
- Always chip away from yourself.
- Do not walk or stand on wet logs

Figure 20. Manual debarking

Debarking of wood may be required for a variety of reasons such as:

- Control of insects
- Acceleration of wood seasoning
- Reduction of weight in transport or
- Simply the demand for wood without bark for instance pulp wood or the demand for the bark itself if it is used for tanning.

Large industries requiring debarked wood are usually equipped with debarking machines installed in the plant. If manual debarking is required, a variety of different tools can be used. As debarking demands much time and effort the tools should be suitable for the job and be handled efficiently. Debarking of small- to medium-sized logs is usually done with debarking spades of which different models exist. A short-handled debarking spade is used for harder bark, a long-handled one for softer bark, to permit working in longer strokes.

5.1.2. Mechanical debarking

Figure 21. Wood log debarking machine

Wood processors have no shortage of options when it comes to debarking equipment. If processors deal with large volumes of wood, they have drum, ring, and roller (rotary or continuous) debarkers to choose from. If they singulate their process, they may consider a rosserhead debarker, ring, or flail debarker. Many contingencies affect their decision, such as capital costs, and whether they scan their logs. Ultimately, processors consider which debarker will make their operation more profitable.

Ring debarkers feed logs through a ring of cutters that mechanically strip a log of its bark. Producers who opt for ring debarkers must singulate the feed into these machines. Ring debarkers are more popular with softwood processors than hardwood processors.

I. Ring Debarker

Advantages

- Low capital costs
- Can remove bark from difficult-to-debark species
- Works well for long, straight logs with large diameters

Ring debarker disadvantages

- Must feed them one log at a time, so producers will need to install a step feeder and elevate the debarker
- High maintenance
- Less-than-optimal log surface quality
- Capacity not as high as roller or drum debarkers
- Can only debark logs within a certain range of diameters
- Does not work well for short logs (lowers production rate)

- Does not work well for logs with small diameters
- Does not always remove bark well from frozen and crooked wood

Figure 22 Ring debarker

II. Roller debarker (rotary debarker)

Roller debarkers are the younger cousins of drum debarkers. Developed in the late ’80s-early ’90s, roller debarkers debark logs using friction and mechanical means. Like drum debarkers, they are an on-mass system and can debark multiple logs at the same time.

Roller debarkers look similar to drum debarkers, but they operate differently. Like drum debarkers, they have a large tube through which the logs travel. This tube, however, is fixed; it is merely sidewalls and a cover. (Smaller roller debarkers may have open tops.) Inside the debarker are a series of rollers equipped with abraders. These abraders act like small hammers that “kick” logs as they pass through, forcing them to move up the side of the debarker until they reach the top and tumble back onto the pile of logs inside the debarker. While this is occurring, all the logs are tumbling against one another. The abraders also cut the log surface to start peeling the bark.

Figure 23. Rollr debarker

Roller debarker advantages

- High capacity
- Can debark logs with both small and large diameters
- Can debark frozen logs
- Can debark species with difficult-to-remove bark
- Can debarked crooked logs and large limbs
- Minimal fiber loss
- High bark removal percentage
- Reasonable capital costs
- Easily retrofitted
- Easily adjusted for species and conditions
- Smaller footprint
- No pretreatment needed (and no effluent)
- Less power required than drum debarkers
- One operator required
- Variety of sizes available

Roller debarker disadvantages

- Capital costs greater than those of a ring debarker
- Installation costs greater than ring debarker
- Won't produce as smooth of surfaces as a rosserhead debarker

Debarking percentage

Debarking percentage is the term used to express the ease of removing the bark from freshly felled tree species. It is the percentage of cleanly debarked logs in a total number of debarked logs.

Debarking % = (Number of cleanly debarked logs ÷ total number of logs sampled) x 100

Cleanly debarked logs are logs where no cambium or less than 30% cambium remains on the log. Chiseled or shaved logs are where more than 30% cambium remains and the bark has to be chiseled off in small pieces.

Figure 24left: Cleanly stripped log, right: Chiseled log.

Some spp. Possible for debarking are :*Eucalypts grandis, Eucalyptus macarthurii, Eucalyptus smithii as well as Acacia mearnsii.*

5.2. Cross-cutting

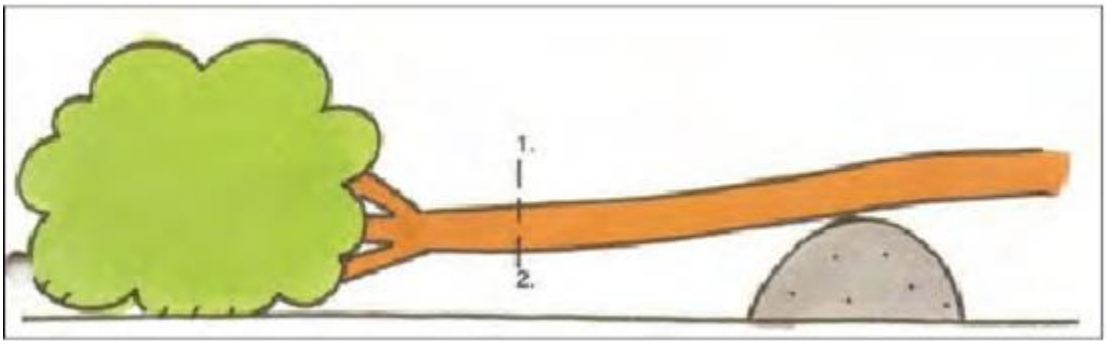
Cross-cutting is the process whereby felled trees are cut into marketable lengths infield or at landings. It is important to use the correct technique when cross-cutting. Using the wrong technique can cause accidents pinching of the saw or splitting of the log.

Observe the following when cross-cutting:

- Determine the stresses the stem is under, example upward, downward or sideways.
- Observe carefully how the timber reacts to being sawn.
- Be aware of where you are standing when you cross-cut.
- Stand off to one side instead of right in front of the cut.
- When cross-cutting stems with sideways tension one must always stand on the inside of the curve when cutting

Demonstrate the cutting technique for the most common tensions a stem can be subjected to:

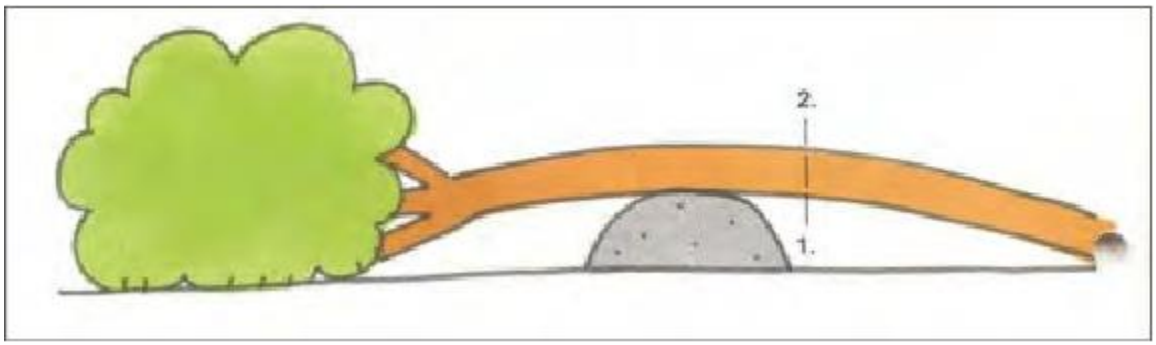
I. Stem with downward tension



Method to use:

- Start by making a cut upwards until the cut begins to pinch the guidebar.
- Continue the cut from the top side downwards. Try to make the two cuts meet..

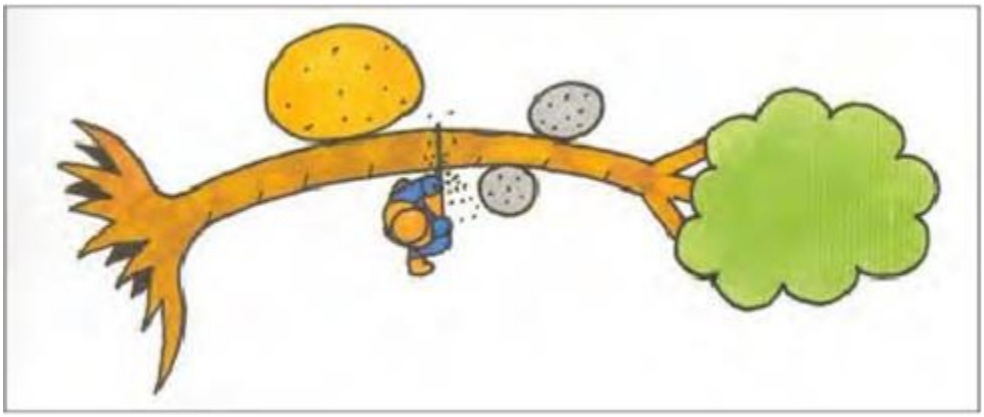
II. Stem with upward tension



Method to use:

1. Start by making a cut downwards until the cut begins to pinch the guidebar
2. Continue the cut from the bottom upwards. Try to make the two cuts meet

III. Stem under sideways tension



Method to use:

- Cut an open directional wedge on the inside or non-stressed side of the stem.
- Start at the top and saw in stages until the stem breaks.
- Remember to always stand on the inside or non-stressed side of the stem.

General rules for cross-cutting

If the tree is not skidded to a landing for cross-cutting, this operation should be done in the forest by the same team which does the felling and debranching to avoid delays and additional time spent on getting to the tree. However, this process requires the presence of qualified supervisors or availability of workers having basic knowledge in timber grading unless only fuelwood is to be produced. The greatest care is required to avoid losses in cross-cutting valuable trees. They should be thoroughly inspected for proper grading before cross-cutting begins. Clear instructions should be given for the grading of different logs. Simply cutting trees from the bottom into uniform log lengths may result in much wastage during utilization. A single tree may be cut into different assortments: for instance higher-quality logs for the sawmill (1a) lower-quality logs for a chipboard plant (1b), and fuelwood (1c). Skilled grading can considerably increase the economic returns of the operation. In many sawmills, it is common for saw logs to go straight from the forest without further cross-cutting into conversion. In such cases, tree shape and quality must be carefully assessed to allow a reasonable degree of recovery in the mill. Heavily tapering trees should therefore be cut into shorter lengths than straight trees with little taper (2). Minimum and maximum log length and size, however, will depend on transport facilities. Crooked logs should normally be cross-cut in the bend and not between the bends (3).

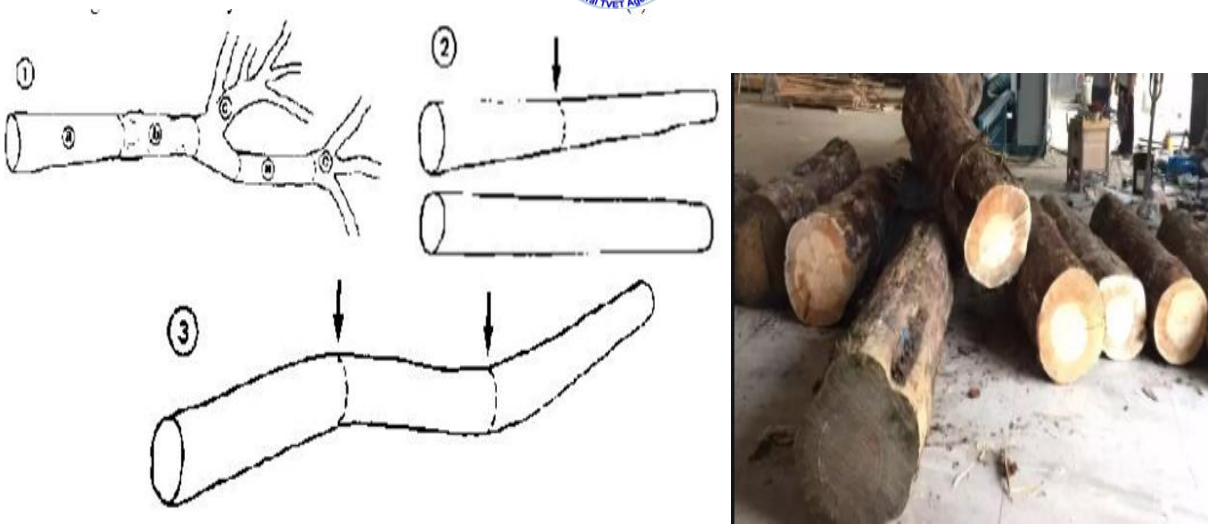


Figure 25. Cross-cutting

5.3. Debranching

Debranching may be a rather time-consuming job especially in coniferous trees. It is done with an axe. For small poles with thin branches matches can also be used. Debranching is a dangerous job and easily causes accidents which may be quite severe especially if a powerful stroke misses the branch and hits the leg. This may happen especially to young inexperienced workers. It is therefore essential never to cut towards the legs to stand as far as possible on the side of the tree opposite the branch that is cut and always to direct the stroke away from the body.

Debranching usually proceeds towards the top of the tree. If branches are thick and under tension it may be preferable first to cut them off some distance from their base and subsequently cut the remaining part flush with the stem. If trees are heavily branched care must be taken to remove cut branches from the tree and to keep the working space clear. After debranching the upper side a turning hook is needed to turn trees or logs.

5.4. Wood wastage

5.4.1 Wood wastage due to poor working techniques in felling

High stumps are an indication of poor workmanship and insufficient supervision. Often th ey are theresult of putting felling marks which are to be left on the stump for control purp oses too high.Sometimes workers find it more comfortable to cut about 1 m above groun d lev. Except in specialcases (e.g. hollow or heavily buttressed trees) the stump should be as low as possible. Avoid wastage of wood and because lower stumps make skiddig

easier.Where the wage level is low and the timber price high the value of wood left in on e stump may correspond to a week's wages or more of the operator.

V= TT r2h or TTd2h where,

4

TT = 3.14,

r or d = radius or diameter of the stump left due to improper harvesting,

h = height of the stamp

Eg. The following table gives information on volume loss:

Stump recoverable height	Diameter cm		
	40	60	80
20	0.025	0.057	0.100
40	0.050	0.113	0.200
60	0.075	0.171	0.300

Self-check 5	Written test

Name…… ID……

Date…….**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers

Test 1. Short Answer Questions

1. List methods used for debarking (5 points)
1. What are the two type o debarking methods (5 points)

Score = _____

Rating: _____

Answer Sheet

Name: _____

Note: **Satisfactory rating - 10 points** **Unsatisfactory – below 10 points**

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Information sheet 6. Transporting logs to storage site

The log or timber transport can be by road, rail, ship or a waterway. Depending on the region and distance, intermodal transport may be used. The most prevail mode of transporting timber is via road transport. For short timber vehicles, they are suitable for timber lengths of up to 6 meters.

6.1. Minor transportation

Assemblage of logs or converted materials together at common point within the forest from the stump site to the points of loading or launching for major transportation.

Choice of transport methods facts to be considered is:

- Cost
- Loss and damage to the produce
- The time factor
- Labour
- Size of timber
- Silvicultural considerations
- Climatic factors
- Value of timber

Types of transport

- Land
- Water
- Over head

1. Transportation by land

Carriage by men: On steep slopes small and medium sized timber like sleepers, poles, small poles and posts and fuel wood carried from forest to some point below and there is least damage

Carriage by animals: Mule, camels, bullocks, dragging by elephants etc. The animal

Bar carts: through special tracks/roads

Dragging: On specially constructed roads for that purposes

Rolling: in areas of gentle slopes

Sliding: Logs allowed sliding downhill by their own weight

Motor transport: Through trucks. The capacity of truck is mostly 1.5 to 5 tons

Tractor Skidding: Very common nowadays for off road transportation

2. Water transportation

- **Cheapest and oldest form of transportation..**

  Floating:

- All softwood float successfully
- Allowing timber to drift with the current , piece by piece without direct control of men, during its passage down the river
- Floating is resorted to, those part of streams which are narrow, shallow or rocky, current too swift for management of rafts

If logs are left in longer period of time many of the species which ordinarily float may become water logged and sink. So floating and sinking ability vary from species to sp. The buoyancy of wood depends on the amount and character of cell cavities in the wood. It is the complete filling of these cavities by water that causes the water logged conditions.

- As for floating, any wood with a specific gravity above 1.0 will sink while wood with a specific gravity below 1.0 will float.
- That's because water has a specific gravity of 1.0 (by definition.) No softwoods and only very few hardwoods sink unless they are fully waterlogged."

Conditions necessary for floating

- Need of ample and reliable flow, throughout season
- Stream should sufficiently large to take large sized logs
- Banks are steep and high as low banks prone to flooding and loss of timber
- Current should be swift
- Stream should flow in the direction of market
- Depth of the stream should be sufficient depending upon size of timber to be floated
- Stream should not be very rapid to avoid damage to material

Advantage of floating

- Cheapest form of transportation, provided favorable conditions of water flow, rainfall and floatable species are present

- Initial investment and operation costs are low. Even unskilled labour can be employed
- Time require to bring timber is short
- Floating adaptable to remote, inaccessible areas and requires very little equipment of an expensive types

Disadvantage:

- Losses occur due to sinkage, breakage in jams and strafing along the banks.
- During unfavorable season it may be considerable 2-25% or more of the total volume
- Applicable to only floatable species
- Affected by cloud burst and floods sometimes causes loss of timber and boom breakage
- Some species liable to sap stain and affected in floating
- Greater edge on damage to logs and timber
- Sand, grit and dirt accumulates may be very harmful to saw mills

Final transport

- The transportation of timber to its final destination or to the market/industry/users
- The most common mean of final transport is “Truck Transportation”. It is common due too vast network of roads even in the remote areas. Tractor transportation is also practiced for transporting timber to the ultimate users from the different storage depots.
- Require transit permit issued by the forest department for transportation of timber from forest to final destination
- Check posts may be established at various exit points to check the outgoing of Forest Produce

Figure 26 Transportation by logging truck

6.2 Manual transport of smaller-sized wood

Carrying wood manually should be avoided as much as possible. It is a heavy and inefficient job which is only permissible over short distances of just a few meters.

Small logs can be pulled more easily to the stacking or loading place using skidding tongs. The tong should be attached close to the end of the log to achieve a lifting effect and thus facilitate pulling.

If the terrain and ground cover permit, the wheelbarrow is an excellent means of assembling loads of short pieces of wood for transport over short distances, e.g. for taking wood to a site for a charcoal kiln

Figure 27. Wood transport by two men

6.3. Use of skidding sulkies

The skidding sulky is used for short-distance transport of small sized logs, especially downhill on moderate slopes. Loads can consist of single logs or bundles and may have a weight of up to 200 kg. On flat terrain, loads are attached at the center of gravity. On increasing slopes, the load is shifted more towards the back to serve as a brake. Skidding sulkies can be built with 2 wheels or with 4 wheels fixed to bogie axles. The latter type is more sophisticated but permits the handling of larger loads and negotiating rougher surface conditions.

Figure 28. Skidding sulkies

6.4 Sliding wood downhill

Timber chutes are used for sliding small logs or short pieces of wood downhill on slopes with a gradient of 25% or more Plastic chutes are commercially available in sections of 5 m and with a diameter of 35-50 cm. At a diameter of 40 cm, the chutes can take logs up to a length of 5 m and short pieces to a diameter of 30 cm. Chutes may be used over distances of up to 150 m. Under favorable conditions, 2 m stacked may be transported per hour over that distance. Commercially-available chutes are easily assembled thanks to different connecting systems.

Chutes may be made locally from plastic tubes cut lengthwise or from other materials, e.g. wooden boards, although these are heavier and more difficult to handle.

In clear-felling areas on moderate slopes, logs may be rolled down to the roadside across trees which have been felled up the slope. They can subsequently be cut into shorter assortments, if necessary, at the foot of the slope. This technique, if applied properly, can save considerable expense in skidding.

6.5 Wood volume

Basically the volume of wood/ log to be transported is measured before transported.

The most commonly used formulas in forestry for determining the cubic-foot content by logs in standing trees are:

Smalian formula: $V = \frac{(B1+B2)}{2} L$

Huber formula: $V = B_{1/2} L$

Where,

V = cubic-foot volume of a log

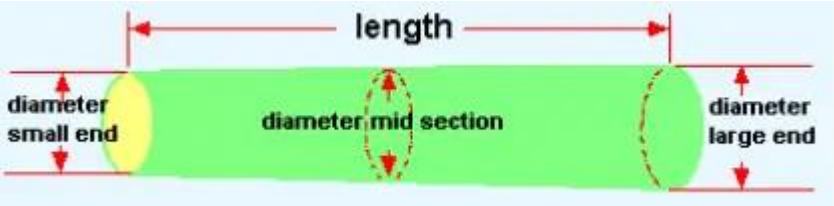
B1 = basal area in square feet of large end of log

$B_{1/2}$ = basal area in square feet of the middle of the log

B2= basal area in square feet of small end of the log

L = length in feet of the log

Huber diameter is measured at mid-section but could be calculated by adding the small end and large end diameter together and dividing this amount by 2.



Huber diameter is measured at mid-section but could be calculated by adding the small end and large end diameter together and dividing this amount by 2.

Diameter average = $\frac{\text{diameter small end + diameter large end}}{2}$

Self-check 6	Written test

Name…… ID……

Date…….**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers

Test 1. Short Answer Questions

2. List methods of wood transporting (5 points)
2. List advantage and dis advantage of manual transporting (5 points)

Answer Sheet

Name: _____

Score = _____
Rating: _____

Note: **Satisfactory rating - 10 points** **Unsatisfactory – below 10 points**

Operation Sheet 2	Perform felling trees in prescribed direction

Objective: To fell trees in appropriate and safe manner

Materials, tools and equipment required:

- Axe
- Saw
- File
- File card
- PPE

Procedure:

1. Wear safety cloths
2. Collect all tools, materials and equipment used.
3. Assess the selected tree felled
4. Place tools and equipment in appropriate place
5. Perform tree felling in prescribed direction

LAP Test	Practical Demonstration

Name: _____ Date: _____

Time started: _____ Time finished: _____

Instructions: Given necessary templates, tools and materials you are required to perform the following tasks within 2 hour.

Task 1- Clear stamp site

Task 2- Determine felling direction

Task 3- Perform tree felling

L #90	LO #4 Use proper seasoning techniques

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Identifying seasoning techniques
- Applying wood drying methods

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Identify seasoning techniques
- Apply proper wood drying methods

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.
2. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
3. Accomplish the “Self-checks” which are placed following all information sheets.
4. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
5. If you earned a satisfactory evaluation proceed to “Operation sheets
6. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
7. If your performance is satisfactory proceed to the next learning guide,
8. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information sheet 1. Identifying wood seasoning techniques

1.1. Introduction

Wood Seasoning is the process of removing the moisture content from wood to minimize structural problems when used in construction or to provide less smoke and more uniform combustion when used as firewood. Dried wood, although lighter than green wood which still contains moisture is stronger less likely to warp or mold and is easier to finish with paint or varnish. The length of the process depends on the type of wood used along with relative humidity in the area where the wood is seasoned. The most common and effective commercial process for drying wood is kiln seasoning which accelerates the process of removing moisture through the use of external energy. Drying takes two days to one weekend depending on the type of wood.

1.2. Objectives of seasoning of wood

The main objectives of seasoning of wood are to:

- Maintain the size and shape of timber.
- Improve strength, hardness and stiffness of timber.
- Make it suitable for receiving various treatments like paints, preservatives, varnishes etc.
- Allow the wood to burn quickly if it is used as fuel.
- Reduce the tendency of the timber to crack, warp, shrink and bend.
- Improve the working properties of timber so that it can be smoothly worked on during conversion.
- Improve the resisting power of timber so that it becomes less prone to fungal and insect attacks.
- Decrease the weight of timber and as a result the cost of transportation and handling is reduced.

1.3. Methods of timber/wood seasoning

There are two methods of seasoning timber. These are:

- Natural seasoning methods and

- Artificial seasoning methods.

1. Natural seasoning methods

In natural or air seasoning of timber, the timbers of convenient sizes are stacked under a covered shed in a cross-wise direction in alternate layers to permit free circulation of air. Generally, air seasoning is a slow process. The actual time of drying depends upon the size of timber, species of wood and seasonal variations of climate. According to Indian Standard code – IS – 1141, timber should not be considered as full air seasoned time is less than six months. The 25 mm thick timber may take three to four months to dry in a moderate climate.

Natural seasoning is the process in which timber is seasoned by subjecting it to the natural elements such as air or water.

Natural seasoning may be:

- Water seasoning or
- Air seasoning.

1. Water Seasoning

Water seasoning is the process in which timber is immersed in water flow which helps to remove the sap present in the timber. It will take 2 to 4 weeks of time and after that the timber is allowed to dry. Well-seasoned timber is ready to use.

Figure 29. Water seasoning

2. Air Seasoning

In the process of air seasoning timber logs are arranged in layers in a shed. The arrangement is done by maintaining some gap with the ground. So, platform is built on ground at 300mm height from ground. The logs are arranged in such a way that air is circulated freely between logs. By the movement of air, the moisture content in timber

slowly reduces and seasoning occurs. Even though it is a slow process it will produce well-seasoned timber.

Advantages of Natural Seasoning of Timber:

- Low investment.
- It does not require skilled labour.
- It is suitable when the market demand is low and non-uniform.

Disadvantages of Natural Seasoning of Timber:

- It needs a larger space for seasoning.
- This process is long and depends on natural air.
- In natural seasoning, the ends of timber dry fast and split. Interior portion of wood may remain moist while exterior part dries quickly.
- During the natural seasoning, there is a possibility of fungal and insect attack.

Figure 30. Natural air seasoning methods

2. Artificial seasoning methods

In the process of artificial seasoning, water is removed from the wood by artificial means. It can be either moderate or rapid. It depends on the temperature of the air injected into the chamber where the timber is piled and on the rate at which the air is circulated and extracted from the chamber.

Types of Artificial Seasoning of Timber:

The various methods of artificial seasoning of timber are:

- Kiln Seasoning of Timber
- Electrical Seasoning of Timber
- Chemical Seasoning of Timber

a) Kiln Seasoning of Timber:

Kiln seasoning is a rapid method of timber seasoning that reduces the moisture content in the timber. In this method, wood is kept in a tight air chamber. The drying arrangements are available inside the chamber. The temperature inside the chamber can be raised with the help of heating elements. When the desired temperature is obtained inside the chamber, the moisture content in timber gets reduced.

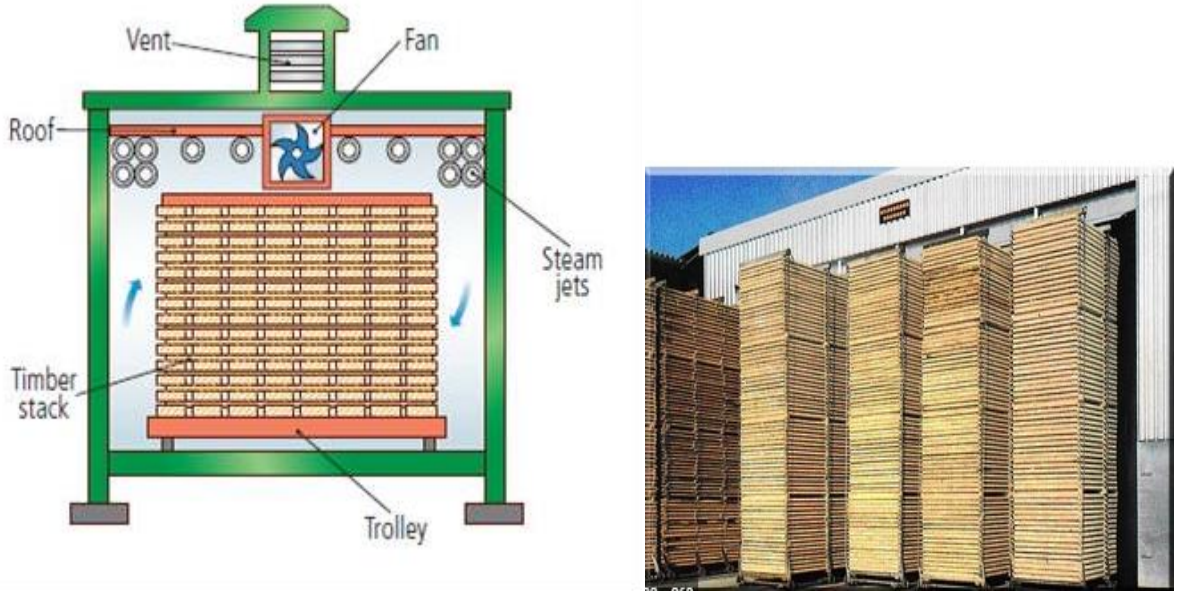


Figure 31. Artificial kiln seasoning

b) Electrical Seasoning of Timber:

In electrical seasoning, the electrodes are kept in contact with the two ends of the timber. Electric current is passed through it and the wood resists the flow of current passing through it. Due to this heat is generated during the process, which results in its drying.

c) Chemical Seasoning of Timber:

Chemical seasoning is also called salt seasoning. In the chemical seasoning, green sawn timber is first soaked in a solution of an anti-shrink or anti-shrink cum hygroscopic chemical for an appropriate period. It is then taken out and treated as air seasoning or kiln seasoning.

Advantages of artificial seasoning of timber:

- In artificial seasoning, the drying is fast and uniform. Therefore, defects in timber such as shrinkage, cracks and wrapping are minimum.
- Moisture content in wood can be reduced to the desired level due to the artificial seasoning. So the chances of fungi and insect attacks are less.
- Timber becomes more suitable for painting after artificial seasoning.

Disadvantages of artificial seasoning of timber:

- It requires high investment, and if the demand for seasoned timber is low and intermittent, it is uneconomical.
- Skilled supervision is needed during artificial seasoning.

Self-check 1	Written test

Name…… ID……

Date…….**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers

Test 1. Choose

1. Which one is method of wood drying methods?

A. Air drying B. Kiln drying C. Chemical drying D. All

2. Which one are not artificial seasoning methods

A. Kiln Seasoning of Timber

B. Electrical Seasoning of Timber

C. Chemical Seasoning of Timber

D. All

E. None

Short Answer Questions

1. List methods of wood seasoning methods (5 points)

Answer Sheet

Name: _____

Score = _____

Rating: _____

Note: **Satisfactory rating - 10 points** **Unsatisfactory – below 10 points**

Information sheet 2. Applying wood drying techniques

Definition

Seasoning of natural wood is the process of removing excess water/moisture content. When a tree is felled it still contains a large proportion of water/moisture usually between forty to fifty per cent water content.

Water is held inside a tree in two ways:

- Free Water
- Cell water:

Free Water: Water that is held in the vessels and cells in order to distribute nutrients inside the tree.

Cell water: Also known as 'bound' water is an essential part of the tree's cell walls.

During the seasoning process a tree loses its free water and a high proportion of its cell water and as a result is less likely to warp or deform.

Wood that has not been seasoned and still has high water content is called 'green wood' and can be more difficult to work with because it has a tendency to change shape.

Moisture content of wood

The moisture content of wood is calculated as the mass change as a proportion of the dry mass by the formula (Siau, 1984):

$$\text{Moisture content} = \frac{m_g - m_{od}}{M_{od}} \times 100\%$$

Where,

m_g = the green mass of the wood

m_{od} = is its oven dry mass (the attainment of constant mass generally after drying in an oven set at 103±2 °C (218±4 °F) for 24 hours as mentioned by Walker *et al.*, 1993). The equation can also be expressed as a fraction of the mass of the water and the mass of the oven dry wood rather than a percentage. For example, 0.59 kg/kg (oven dry basis) expresses the same moisture content as 59% (oven dry basis).

There are different types of technique applied for wood seasoning. From which the three main wood drying techniques are:

- Air drying

- sun drying
- Kiln drying

1. Air Seasoning

The traditional method for drying wood, air seasoning is also the longest, taking six to nine months. To air season wood, stack logs or planks outside on pallets in such a manner that air can circulate vertically and horizontally through the timbers. The raised pallets also keep wood away from vegetation and damp ground. Plank and log ends are often wrapped or sealed to prevent excessive moisture loss through these areas. Protect the drying wood from the elements with an overhead canopy.

Air seasoning of timber.

This is as yet the most common process of seasoning of timber used throughout the world.

In this process, timber sleepers, planks, etc., cut from the wood logs are stacked in the open air.

This method requires careful preparation of;

(a) Stock ground: It should be level, free from debris and on dry land. It may be a few "cm" below the ground level.

(b) Stack Pillars: These are constructed at regular intervals out of bricks or masonry or concrete and may be of 50 cm height from the ground level. Their top surfaces should be flat and level with each other.

(c) Stack Proper. These are made of sawn timber shapes (sleepers, planks). One stack should have timber of one shape and same length and width.

The timber shape to be seasoned is stacked in layers in such a manner that:

- Enough space is left between one layer and another layer above it;
- Enough space is left between one part and another part in the sum layer:
- Enough space is left between one stack and another stack.

The stack length and height depend upon the length of the wood part being seasoned. A single stack may be 3 to 4 meters in height.

The most essential consideration in making such a stack is ensuring free circulation of air around each part of the wood placed in a stack.

It is also essential that the stack should be safe from direct winds and direct scorching heat. This is because, in air seasoning of timber, the loss of water is due to evaporation.

The rate of evaporation will depend to a great extent on the atmospheric conditions. Efforts should be made to maintain a uniform rate of evaporation.

Scorching heat and strong winds can cause excessive evaporation that may lead to the development of shrinkage cracks.

The seasoning stack should also be protected from rains because wood being hygroscopic material can absorb moisture quickly.

Outline of Stacking Arrangement: The time taken for air seasoning of timber depends on climatic conditions and thickness of the timber. It may take 1-4 years to bring down the moisture content to 16-17 percent level.

The advantages of natural (air) seasoning are:

- It is highly economical;
- It requires little supervision;
- It is applicable to thicker timber parts as well as a thin section.

Disadvantages of Air Seasoning:

Among the major disadvantages, following are more important:

- It is a very slow process;
- It keeps the valuable land and timber blocked for longer periods (and hence in some cases may be uneconomical).
- Moisture content cannot be brought below a certain limit (16-17 percent).
- Seasoning is not always uniform in all the sections of timber.

2. Kiln Seasoning

The most common and effective commercial process for drying wood is kiln seasoning, which accelerates the process of removing moisture through the use of external energy. Drying takes two days to one weekend, depending on the type of wood. Two methods, progressive and compartmental, are used for kiln seasoning. In a progressive kiln, timber enters at one end and travels on a trolley through chambers with different air conditions to progressive dry the wood. This method produces a constant flow of seasoned timber. Wood seasoned via the compartmental process remains in a single building where it is subjected to a program of varying conditions until the moisture content is removed. This process is used for hard-to-dry or expensive wood.

This is the modern method of seasoning any type of timber in a short time.

It involves drying the timber in a specially designed kiln where there is perfect control over temperature, humidity and air circulation.

With the help of kiln seasoning of timber, it is possible to reduce the moisture content to as low level as 6 percent.

The method involves broadly the following steps:

(a) Timber is stacked properly in the kiln keeping open spaces for air circulation. The kiln is then heated to low initial temperatures, only slightly higher than the atmospheric temperature outside.

It is kept at that temperature for some time.

This initial low heat is essential to avoid cracking or splitting of timber which would become certain if the temperature is suddenly raised to high drying rates.

In that case, moisture from the surface of the wood will dry out fast (causing shrinkage) whereas moisture in deeper cells will be slow in moving out.

In slow heating, this risk is adequately covered.

(b) Once the timber has been at low heat and good humidity for some time, the temperature of the kiln is raised.

Humidity is reduced, and air circulation is made faster.

In this way a continuous process of loss of moisture from the deeper cells to the outer cells of the timber and from there to 'outside' the kiln starts.

(c) During the heating process, all efforts are made to maintain a uniform circulation of the air so that all the parts of timber in a pile receive the same amount of heat.

This aspect is the most difficult one in kiln seasoning and requires expert handling for good quality seasoning.

Many modifications of kilns for seasoning timber are available. It is a costly method, no doubt but the quality of seasoned timber is highly satisfactory.

3. Sun drying

Sun drying is a traditional drying method for reducing the moisture content of paddy by spreading the grains under the sun. Solar dry kilns offer a relatively inexpensive way for the woodworker or hobbyist to dry small quantities of wood. Drying times depend on the weather, and electricity is needed to run kiln fans. The heat energy necessary for drying comes from a solar collector. Depending on the chosen design moist air can be removed through vents or condensed on the cold solar collector at night. Solar drying

can result in high quality lumber, primarily because the moisture gradients in the lumber are allowed to equalize at night when drying is not taking place. Drying times vary and are relatively long.

Self-check 2	Written test

Name…… ID……

Date…….**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers

Test 1. Short Answer Questions

1. List methods of wood drying (5 points)

3. List advantage and dis advantage of natural (air) seasoning (5 points)

Answer Sheet

Score = _____
Rating: _____

Name: _____

Note: **Satisfactory rating - 10 points** **Unsatisfactory – below 10 points**

L #91	LO #5 Selecting temporary processing and storage site

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Selecting and designing processing and storage sites
- Stacking processed logs

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Select and design processing and storage sites
- Stack processed logs

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.
2. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
3. Accomplish the “Self-checks” which are placed following all information sheets.
4. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
5. If you earned a satisfactory evaluation proceed to “Operation sheets
6. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
7. If your performance is satisfactory proceed to the next learning guide,
8. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information sheet 1. Selecting and designing processing and storage sites

1.1. Selecting and designing wood processing and storage site

Storing of timber on site

- Store the timbers in stacks upon well treated and even surfaced beams sleepers or brick pillars so as to be above the ground level by at least 150 mm.
- Store members of different length and material separately.
- Materials of equal length are piled together in layers with wooden batters, called crossers, separating one layer from another.
- If crossers are not available, smaller section of the available structural timber can be used in their place.
- Provide an air space of about 25 mm between adjacent members.
- Place the longer pieces in bottom layer and shorter pieces in the top layer, but keep one end of the stack in true vertical alignment.
- Suitable width and height of a stack are recommended to be about 1.5 m to 2.0 m.
- Distance between adjacent stacks is recommended to be at least 450 mm. (see figure shown below).

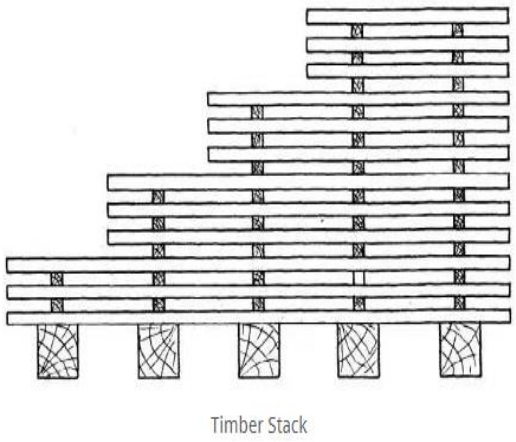


Figure 32. Timber stacking and storage site deign

- Protect the stacks from hot dry winds, direct sun and rain.

- It is recommended to place heavy weight, such as metal rails or large section of wood, on top of the stack to prevent distortion or warping of the timber in the stack.
- If it is required to store the timber for about an year or more, then coat the ends of all members with coal tar, aluminum leaf paints, micro crystalline wax; to prevent end cracking in the material.

1.2. Management of depots

(i) Staff: Under the charge of responsible officer, assisted by other persons according to local requirements.

(ii) Layout:

- Should be well planned
- Specious
- Separate for each sp.
- Proper sign board for display
- Plot separated by wide passage for inspection, to allow cart, truck to pass through

1.3. Classification or sorting

- ✓ Well graded timber sell better
- ✓ Mixing of good timber with other is avoided
- ✓ Timber of equal size, specification kept in lots
- ✓ Lots should be of equal size

1..4. Stock checking

- ✓ Thoroughly checked periodically eg at 3 ,6 or 1yr interval and reported to competent authority
- ✓ Firewood, charcoal, resin etc. losses inevitable . Such losses should be verified and written off under proper authority so that balance agree

1.5. Protection

- ✓ Protection against fire and theft essential
- ✓ Day and night vigilance is required
- ✓ Fire protection notices displayed
- ✓ No inflammation material should be there
- ✓ Depots should be fenced, gate etc.

Self-check 1	Written test

Name…… ID……

Date…….**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers

Test 1. Short Answer Questions

1. List activities to be considered during stacking log (5 points)
2. How we layout log stacking site (5 points)

Answer Sheet

Name: _____

Score = _____
Rating: _____

Note: **Satisfactory rating - 10 points** **Unsatisfactory – below 10 points**

Information sheet 2. Stacking processed logs

Stacking

Proper stacking of wood at the roadside prior to transport aids seasoning reduces weight and provides protection against deterioration. Stacking should if possible be done on the higher side of the road embankment if this facilitates loading. Logs and poles should be placed on supports and be easily accessible for loading. Short wood is usually piled in stacks which also require supports. The stacks should be firmly secured by one or more stakes. Small sized material used for fuel can be bundled prior to stacking and is thus more easily handled and marketed.

Stacking and storing of wood applied to safe the log from damage and keep its durability.

Stacking logs activities include:

- Closed stacking to economic space
- Closed stacking provide un protection
- Logs, sawn timber, planks and fire wood should stacked separately
- Ensure free circulation of air
- If log measurement not required it can be placed in heap
- Fuelwood should be stacked in sections eg. multiple of 10 for recount
- Valuable timber and minor forest produce should be stored in sheltered places under the shade
- All the stacks should be classified, serially numbered and labeled properly for easy inspection by the purchaser
- It may be stacked within the the forest itself before final disposal with main consideration that to prevent its degradation, protection against insect and fungal attack and allow it to season slowly
- The logs should not be stacked on the ground. The lowest tier is kept off by skids which can be off round or square pieces.

- Logs in each tier should have their but ends on one sides, alternating in successive tiers
- Sawn timber should be stacked in the same way except that skidding between various tiers is not necessary
- The lowest tier should be leveled to avoid warping
- A couple of cm space is provided between sets for free circulation of air
- Two successive tiers will be at right angle to each other
- Thin planks, scantlings should be should be stacked solid on a level site
- Poles and posts should be stacked either horizontally between pairs of vertical posts firmly fixed in ground or placed vertically by leaning them against a tree with their thick end on ground .Bamboo can be stacked similarly

Self-check 2	Written test

Name…… ID……

Date…….**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers

Test 1. Short Answer Questions

1. List the way of stacking logs (5 points)

Answer Sheet

Name: _____

Score = _____

Rating: _____

Note: **Satisfactory rating - 10 points** **Unsatisfactory – below 10 points**

LG#92	LO #6 Sort processed forest product at permanent storage site

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Selecting, designing and constructing permanent storage sites
- Classifying processed forest products
- Binding and stacking processed products in their size and quality
- Making sorted forest products for market

Documenting and reporting work completin and outcomesThis guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Select, design and construct permanent storage sites
- Classify processed forest products
- Bind and stack processed products in their size and quality
- Make sorted forest products for market

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.
2. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
3. Accomplish the “Self-checks” which are placed following all information sheets.
4. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-checks).
5. If you earned a satisfactory evaluation proceed to “Operation sheets
6. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
7. If your performance is satisfactory proceed to the next learning guide,
8. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information sheet 1. Selecting, designing and constructing permanent storage sites

1.1. Site selection

Site storage involves the provision of adequate space, protection and control for materials, components and equipment that are to be kept on a construction site during the building process.

There are several factors to be considered when deciding on the amount and nature of storage required.

Physical properties: The size, shape, weight and mode of delivery.

Organization: The planning process to ensure unloading is available and storage space has been allocated.

Control: Processes for checking the quality and quantity of materials on delivery, and monitoring stock holdings.

Protection: The necessary protection for durable and non-durable materials and components from damage.

Security: Guarding against theft and vandalism.

Costs: Costs associated with handling, transporting and stacking requirements, the workforce required, heating and/or lighting that may be required, facilities to be provided for subcontractors, and so on.

Processing: What needs to be done to materials before they can be used. Is there packaging that needs to be removed or returned?

Programme: When are items required, what is the risk to the project of them not being available, how long in advance are they ordered and how long they will be on site.

Ownership: Who is legally responsible for items, who will be using them and who owns them?

1.2. Site allocation

The location and size of space to be allocated should be planned carefully as part of an overall site layout plan and each site will present its own problems. Failure to adequately

plan for storage space can result in congestion, or having more materials on site than storage space allows for.

The most appropriate position on site in terms of handling, storage and convenience should be determined. Unloading deliveries should take place in a clearly marked designated area away from other site operations, supervised by a competent person.

The distance between storage areas and the area materials are to be used should be reduced as much as possible to keep the time and cost required to transport them from place to place at a minimum. Alternatively, storage areas could be positioned within the reach of a tower crane which can then be used to move materials as required.

1.3 Materials storage

Different types of material will have different storage requirements, in particular depending on whether they are durable or non-durable.

Bricks

Bricks may be delivered to site loose or strapped in unit loads and stored on timber pallets to be transported using a forklift. Bricks should be stacked on edge in rows to a maximum height of 2.4 m. It is important that they are stored on level, well-drained ground and covered with a polythene sheet to protect against efflorescence and other issues. When calculating the area required for storage, allowance of around 5 m should be given for the forklift approach.

Blocks

Blocks may be delivered to site loose or strapped in unit loads on timber pallets. They should be stacked in columns, to a maximum height of 8 courses, and covered with a protective sheet.

Roofing tiles

Tiles may be delivered to site loose, in plastic-wrapped packs or in unit loads on timber pallets. They should be stacked vertically in rows, to a maximum of 6 in height. The tiles at the end of the row should be laid flat and staggered. Ridge tiles should be stored vertically on end.

Drainage pipes

These are usually supplied loose or strapped together on timber pallets. They should be stacked horizontally with ends reversed in alternate rows. A driven-in timber stack or column of loose bricks can be used to form end restraints.

Corrugated and similar sheet materials

These should be stored flat on a level surface and covered with a protective polythene sheet.

Timber

Timber and other joinery items should be stored horizontally and covered in a scaffold rack, although provision should be made for free air flow, usually by the rack having open ends and sides, while having a top that is covered. It is advisable for different timber sizes to be kept separate.

Self-check 1	Written test

Name…… ID……

Date…….**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers

Test 1. Short Answer Questions

1. Factors to be considered when deciding on the amount and nature of storage required (5 points)

Answer Sheet

Name: _____

Score = _____
Rating: _____

Note: **Satisfactory rating - 10 points** **Unsatisfactory – below 10 points**

Information sheet 2. Classifying processed forest products

2.1. Wood processing

Wood is processed by wood processing machine, single sawing machines-sawmill usually saw into sizes for multipurpose functions basically the respective wood usage namely for:

- Furniture,
- Roofing,
- Carpentry, etc.

The processing of wood involves the conversion of wood into pulp, plywood, particleboards, paper, etc. The area of concern is wood lumbering as means of wood processing. it involves sawing of woods in different sizes namely log (4 x 6 x 12ft), (2in x 6 x 12ft) and so on as the market demand. This size may be for immediate use or for drying for those who have dryer chambers or kiln. After drying to re move moisture content, this is usually done to retain its original shape. The dried wood is further processed into finished product like floor tiles and ceiling board.

2.2. Classification of processed wood

Main classification criteria include:

- Chief component material
- Stage of manufacture
  - ✓ Crude materials
  - ✓ Products of first processing
  - ✓ Products of further processing
- Technology applied in production
- Purpose or intended use

Classification of processed wood includes:

Cover each principal stage of operation from the initial felling of the tree to the manufacture of secondary products

- Primary wood products
- Primary paper products

- Secondary wood products
- Secondary paper products

Processed wood and its value

- Plywood and veneers
- Furniture and high class joinery
- Heavy construction
- Utility timber (that is general purpose woodwork)
- Pulp and matches
- Specialized uses (tools and carving)

Self-Check 2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part I Fill the black space

1. List the purpose of processed wood **(4%)**
2. List main classification criteria of processed wood (6%)

. Answer the following question!

Note: Satisfactory rating 10 points **Unsatisfactory below 10 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Name: _____

Score = _____
Rating: _____

Date: _____

Note: **Satisfactory rating -10 points** **Unsatisfactory – below10 points**

Information sheet 3. Binding and stacking processed products in their size and quality

Stacking and storing of wood proper stacking of wood at the roadside prior to transport aids seasoning reduces weight and provides protection against deterioration. Stacking should if possible be done on the higher side of the road embankment if this facilitates loading. The way which processed wood stack is as following:

- Logs and poles should be placed on supports and be easily accessible for loading.
- Short wood is usually piled in stacks which also require supports.
- The stacks should be firmly secured by one or more stakes.
- Small-sized material used for fuel can be bundled prior to stacking and is thus more easily handled and marketed.

All lumber must be sealed at each end with a vapor resistant sealant to prevent it drying out from the ends and stacked under cover as quickly as possible within 24 hrs after coming off the saw. These stacks must be stored under some form of protection from rain on a clean (free of obstacles to air flow and vegetation that harbors fungus and bacteria) well drained area on blocks off the ground to allow a free flow of air around the pile. Blocks should be 12 (304.8mm) – 24 inches (609.6mm) apart and stickers should be aligned with the blocks and with the rows above in the lumber piles to prevent distortion of the lumber. The softer the wood and thinner the pieces the smaller the gaps between the stickers. Stickers must be accurately sawn or preferably planed at least ¾ x ¾ inches (19.05mm x 19.05mm) or wider to allow free flow of air – there may be some advantages with fast drying softwoods to use thicker stickers to speed the air drying process.

Self-check 3	Written test

Name…… ID……

Date…….**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers

Test 1. Short Answer Questions

1. What do we consider to stack processed wood(5 points)

Answer Sheet

Name: _____

Score = _____
Rating: _____

Note: **Satisfactory rating - 10 points** **Unsatisfactory – below 10 points**

Information sheet 4. Making sorted forest products for market

The economic returns derived from wood processing are significant compared to that of primary production of logs for as the value chain extends there is a significant increase in returns and contribution to the economy. Wood processing manufacturers have been able to diversify into new products such as:

- Veneer
- Niche-market furniture
- Household components
  - ✓ doors
  - ✓ Kiln-dried lumber.

Any investor/wood processor should focus on the following to match the wood processed resource to the markets:

- Focus on niche markets that are lower volume but more dynamic in nature – niche markets tend to be very quality conscious.
- Flexibility in production at all levels to be able to adapt equipment and techniques to meet the varying and dynamic demands inherent in niche markets.
- Target markets that they can effectively compete in – focus more on markets that have low volumes and high value so as to be able to compete with the big producers who find these small markets difficult to deal with

Self-check 4	Written test

Name…… ID……

Date…….**Directions:** Answer all the questions listed below. Examples may be necessary to aid some explanations/answers

Test 1. Short Answer Questions

1. What are some economic returns derived from wood processing (5 points)

Answer Sheet

Name: _____

Score = _____
Rating: _____

Note: **Satisfactory rating - 10 points** **Unsatisfactory – below 10 points**

L #93	LO #7 Record and report work

Instruction sheet

This learning guide is developed to provide you the necessary information regarding the following content coverage and topics:

- Recording and reporting forest harvesting and post harvesting procedures
- Reporting problems or difficulties in completing work
- Documenting and reporting work completin and outcomes

This guide will also assist you to attain the learning outcomes stated in the cover page. Specifically, upon completion of this learning guide, you will be able to:

- Record and report forest harvesting and post harvesting procedures
- Report problems or difficulties in completing work
- Document and report work completion and outcomes

Learning Instructions:

Read the specific objectives of this Learning Guide.

1. Follow the instructions described below.
2. Read the information written in the “Information Sheets”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
3. Accomplish the “Self-checks” which are placed following all information sheets.
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5. If you earned a satisfactory evaluation proceed to “Operation sheets
6. Perform “the Learning activity performance test” which is placed following “Operation sheets” ,
7. If your performance is satisfactory proceed to the next learning guide,
8. If your performance is unsatisfactory, see your trainer for further instructions or go back to “Operation sheets”.

Information sheet 1. Recording and reporting forest harvesting and post harvesting procedures

1.1 Recording operation procedures

Recording is an essential task in any work activities. It is necessary for planning, monitoring and reviewing progress at individual, service, organizational and locality levels. Recording ensures that there is a documented account of work undertaken. It supports continuity of forest harvest and post-harvest operation when there is a change of any situation and provides a means for managers to monitor work. Recording is a major source of evidence when there are critical incidents or enquiries.

Recording is essential to:

- Collect information about the operation activities
- Analyze the outcome focused service development
- Improve the outcome focused assessment and planning
- Record ongoing support activities
- Monitor outcome focused review

SMART principles can usefully be employed when discussing and recording the operational outcomes.

Your record has to be:

S - Specific (or Significant).

M - Measurable (or Meaningful).

A - Attainable (or Action-Oriented).

R - Relevant (or Rewarding).

T - Time-bound (or Trackable)

1.2. Reporting harvesting and post harvesting procedures

Report is a statement of the results of an investigation or of any matter on which definite information is required. The following stages are involved in writing a report:

- Clarifying your terms of reference
- Planning your work
- Collecting your information
- Organizing and structuring your information
- Writing the first draft

- Checking and re-drafting

Some activities included in recording and reporting are:

- Harvesting and post harvesting procedures
  - Site delineation
  - Identifying trees harvested
  - Clearing
  - Felling
  - Debranching
  - Cross cutting
  - Debarking
  - Transporting
  - Storage etc.
- Quality outcomes or technology requirements
- Environment safety assessment
- OHS and hazard issues,
- Difficulties or problems Wastage/damage of tools, equipment and machinery
- Workout comes

Self-Check 1	Written Test

Answer the following question

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part I Fill the black space

1. Why recording is important **(**4%**)**
2. List the important activities that recording in forest harvesting operation (6%)

.

Note: Satisfactory rating 10 points **Unsatisfactory below 10 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Note: **Satisfactory rating - 10 points** **Unsatisfactory – below 10 points**

Information sheet 2- Reporting problems or difficulties in completing work

2.1. Reporting problems

There are many problems or difficulties in completing work such as:

- Non-routine process and quality problems
- Equipment selection
- Availability and failure of doing tasks
- Teamwork and work allocation problem
- Safety and emergency situations and such incidents.
- Identify problems, environmental issues and equipment faults

2.2. Reporting difficulties in completing work

These include**:**

- Common Workplace Issues
- Interpersonal conflict.
- Communication problems.
- Discrimination.
- Low motivation and job satisfaction.
- Performance issues.

Self-Check 2	Written Test

Answer the following question!

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part I Fill the black space

1. List reporting problem **(**4%)

2. Write down reporting difficulties (3%)

List down things that work place documentation contains

Note: Satisfactory rating 7 points **Unsatisfactory below 7 points**

You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Answer Sheet

Name: _____ Date: _____

Note: **Satisfactory rating - 10 points** **Unsatisfactory – below 10 points**

Information sheet 3- Documenting and reporting work completion

3.1. Documenting work completion

Documentation plays a crucial role in any treatment setting. Documentation helps to assure continuity of care and assist the adopter/farmers. It's important for practitioners, who may serve the community down the line have proper information. Not all documents are records. A record is a document consciously retained as evidence of an action.

Workplace documents measures skills that individuals use when they read real workplace documents and use that information to make job-related decisions and solve problems.

The work place documents include:

- Messages
- Emails
- Letters
- Directions
- Address
- Policies and regulations.

Records management systems generally distinguish between records and non-records (convenience copies, rough drafts, duplicates), which do not need formal management. Many systems, especially for electronic records, require documents to be formally declared as a record so they can be managed. Once declared, a record cannot be changed and can only be disposed of within the rules of the system.

3.2. Reporting work completion

As its name implies, a completion report is written when an operational activities has come to an end. Work completion report is a section in the settings of every activity and resource that allows you to set how that activity or resource can be marked as complete.

Self-Check 3	Written Test

Answer the following question!

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

Part I Fill the black space

1. Why documenting work operation is important (4%)
2. List down things that work place documentation contains (3%)

.

Note: Satisfactory rating 7 points **Unsatisfactory below 7 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Note: **Satisfactory rating - 10 points** **Unsatisfactory – below 10 points**

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