

# USDA Forest Service National Sawyer Training: Developing Thinking Sawyers



## Student Guide: Classroom

**USDA Forest Service National Sawyer Training:**  
**Developing Thinking Sawyers**  
Module 1: Introduction to Saw Operations

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## About this Course

You are participating as a student in the U.S. Department of Agriculture (USDA), Forest Service National Sawyer Training course. This course, “Developing Thinking Sawyers,” is intended for employees and volunteers who apply for certification as a sawyer. The use of saws on National Forest System (NFS) lands is prohibited unless an individual is trained, evaluated by a qualified sawyer evaluator, and has received a national sawyer certification card.

This module-based training focuses on **developing a thinking sawyer** and emphasizes risk management, human factors, and sawyer safety. The evaluation process may be separate from this training to allow sawyers time to practice their skills under the supervision of an approved sawyer instructor. Completing this training program does not guarantee certification.

## Course Outline

These training materials are intended for Forest Service employees, agency volunteers, cooperators, and training consultants who use chain saws or crosscut saws on NFS lands. The materials provide operational information for the safe and efficient use of chain saws or crosscut saws and companion tools.

For the purposes of this training, the terms **saw** or **saw program** refer to both chain saws and crosscut saws, unless otherwise specified.

### □ **Module 1: Introduction to Saw Operations**

The “Introduction to Saw Operations” module covers National Saw Program policy and legal requirements, sawyer safety, situational awareness, identification of risk, risk management, and developing a standardized OHLEC (objective, hazards, leans/binds, escape path, cut plan) size-up process.

### □ **Module 2: Chain Saws**

The “Chain Saw” module contains three sections: “Chain Saw Basics,” “Bucking and Limbing,” and “Felling.” The section(s) you require will depend on the certification level you pursue.

### □ **Module 3: Crosscut Saws**

The “Crosscut Saw” module contains three sections: “Crosscut Saw Basics,” “Bucking and Limbing,” and “Felling.” The section(s) you require will depend on the certification level you pursue.

### □ **Module 4: Ax Basics, Maintenance, and Use**

The “Ax Basics, Maintenance, and Use” module covers ax basics, maintenance, safety, and use.

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#### □ **Module 5: Fireline Operations**

The “Fireline Operations” module covers fireline safety, the sawyer/swamper team, cutting area control, saw team tasks and tactics, and terminology.

#### □ **Module 6: Wedges**

The “Wedges” module covers wedge design and the mechanical advantage wedges provide, various wedge types, proper wedge placement and use, and how to calculate the amount of lift using tree diameter and height.

#### □ **Module 7: Hung-Up Trees**

The “Hung-Up Trees” module defines the term “hung-up trees” and identifies the hazards associated with them, discusses avoiding hung-up trees, explains the OHLEC process for them, and provides techniques for mitigating or removing them.

### Purpose of Course

The USDA Forest Service “National Sawyer Training: Developing Thinking Sawyers” course outlines and describes the operational procedures for the use of saws by Forest Service employees, volunteers, and cooperators. These operational procedures are considered best practices that are designed to protect sawyers from accidental injury or death during saw operations.

All sawyers must be trained, evaluated, and certified through an approved training program, in accordance with FSM 2358. To engage in sawing activities, sawyers must acquire and maintain a USDA Forest Service national sawyer certification card and first aid/cardiopulmonary resuscitation (CPR) certification. This national sawyer certification card has a 3-year expiration date and can be subject to review at any time before it expires.

### Course Goal

The “Developing Thinking Sawyers” course is designed to provide employees, volunteers, and cooperators who are basic to intermediate chain saw and crosscut saw users with the technical knowledge to use these tools safely and effectively.

At the completion of training, a qualified sawyer evaluator will conduct a field evaluation to determine whether a student demonstrates safe saw handling skills and a basic knowledge of course content. The field evaluation will identify the level of certification at which each student is authorized to perform saw work based on the student’s ability to apply learned knowledge and skill in front of an approved sawyer evaluator.

### Sawyer Certification Preparation

Use the checklist in table 1.0.1 to ensure you have completed everything you need to successfully become a certified sawyer.

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**Table 1.0.1—Certification checklist.**

	Prior to Certification
	Be at least 18 years old to operate a chain saw, 16 years old to operate a crosscut saw.
	Receive first aid training and have current certification in cardiopulmonary resuscitation (CPR).
	Complete an approved, nationally recognized sawyer training curriculum (NRSTC) from an authorized instructor.
	Successfully complete a field evaluation.
	Possess a national sawyer certification card signed by an authorized certifying official.



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## Module 1: Introduction to Saw Operations

Welcome to the USDA Forest Service “National Sawyer Training: Developing Thinking Sawyers” course. This course will begin or continue your journey to becoming a “thinking sawyer.” This course is designed to provide the technical knowledge and skills that you need to safely use chain saws and/or crosscut saws and their associated tools.

### Introduction

This training course outlines and describes the operational procedures for the use of saws by Forest Service employees, volunteers, and cooperators. These operational procedures are considered best practices that are designed to protect sawyers from accidental injury or death during saw operations.

All sawyers must be trained, evaluated, and certified through an approved training program, in accordance with FSM 2358. To engage in sawing activities, sawyers must acquire and maintain a USDA Forest Service national sawyer certification card and first aid/cardiopulmonary resuscitation (CPR) certification. The national sawyer certification card has a 3-year expiration date and can be subject to review at any time before it expires.

### Module Objectives

When you complete this module, you will be able to:

- Recall the guiding documents associated with the Forest Service National Saw Program and its policies.
- Recognize the levels of sawyer certification.
- List the three key safety concepts.
- Identify the required personal protective equipment (PPE) and its proper fit for both nonfire and fire use.
- Identify and discuss how human factors affect sawyer operations.
- Identify and discuss components of the objective, hazards, leans/binds, escape path, cut plan (OHLEC) size-up process.
- Discuss operational complexity and its relationship to a sawyer’s knowledge and skill.

### Prework Review

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#### *Policy and Regulations*

As a Forest Service sawyer, you must be aware that there are laws and standards that you must meet before you operate a chain saw or crosscut saw. Forest Service policy is made up of two main components—overarching Federal regulation and program policy. Other documents, such

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as the Forest Service Saw Operations Guide (FSSOG) and training materials, help provide saw program guidance.

#### *Overarching Federal Regulations*

The Occupational Safety and Health Act of 1970 is a United States law (Public Law 91-596) that enforces workplace standards to ensure employees are protected from hazards that may compromise their safety and health.

The USDA Forest Service National Sawyer Training course falls within the regulatory authority of the Federal Occupational Safety and Health Administration (OSHA) under 29 Code of Federal Regulations (CFR) 1910.266—Logging Operations.

#### *Program Policy*

Forest Service Manual (FSM) 2358—Saw Program addresses program requirements and applies to all employees, volunteers, training consultants, and cooperators who use chain saws and/or crosscut saws on NFS lands by. It does not apply to other Federal, State, Tribal or local government agencies, contractors, or those working under interagency fire management cooperative agreements. FSM 2358 defines administrative responsibilities for the program as well as sawyer responsibilities and requirements for safety, training, and proficiency evaluation and reevaluation.

#### *Questions*

Take a few moments to answer the questions below, then discuss them with your instructor and the class.

List three documents that guide the Forest Service National Saw Program and policy.

Where can you find information about individual responsibilities in the National Saw Program?

What are the three key safety concepts?

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Where can you find required PPE?

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## Safety

Safety is a critical concern in chain saw and crosscut saw operations. It should be a part of every plan you prepare and every action you take (figure 1.0.1). Careful study and practice of saw operations will improve your abilities and help you to identify your limitations. Sawyers are obligated to say "no" and to walk away from any situation they determine to be an unacceptable risk.

Sawyer safety comes down to two key concepts: risk management and proper use and fit of PPE.



**Figure 1.0.1—Sawyers doing a stump analysis.**

### Personal Protective Equipment: Nonfire

PPE is a requirement that OSHA instituted to help protect sawyers from injury. The type of PPE you require (table 1.0.2) depends on the type of saw you use and whether you are working in a fire environment.

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**Table 1.0.2—Nonfire personal protective equipment (PPE) requirements (ANSI = American National Standards Institute, OSHA = Occupational Safety and Health Administration, dB = decibels).**

<b>PPE</b>	<b>Chain saw operations</b>	<b>Crosscut saw operations</b>
<b>Head protection</b>	A helmet that meets ANSI Z89.1	Same as chain saw
<b>Eye protection</b>	ANSI Z87.1 safety glasses or equivalent: mesh bug-eye type or mesh face shield (OSHA Note: 910.266(d)(1)(vii)(B))	Same as chain saw
<b>Hearing protection</b>	Hearing protection (85 decibels and above)	None required
<b>Hand protection</b>	Chain saw mitts or gloves appropriate for the weather conditions	Gloves appropriate for the weather conditions
<b>Shirt</b>	Long sleeves required	Long sleeves optional
<b>Pants</b>	Loose-fitting without a solid hem or with a hem you can tuck into your boots	Same as chain saw
<b>Leg protection</b>	Chaps or cut-resistant pants that overlap your boots by at least 2 inches	None required
<b>Foot protection/boots</b>	Cut-resistant, laced boots that provide ankle support and have nonskid soles	Boots that provide ankle support and have nonskid soles

**Personal Protective Equipment: Fire**

When operating a saw in a fire environment, sawyer PPE requirements differ from those used in a nonfire environment (table 1.0.3). Sawyers on the fireline must wear all PPE required by the “Interagency Standards for Fire and Fire Aviation Operations (Redbook) Chapter 7—Safety and Risk Management.”

**Table 1.0.3—Fire personal protective equipment (PPE) requirements (NFPA = National Fire Protection Association, ANSI = American National Standards Institute).**

<b>PPE</b>	<b>Chain saw operations</b>	<b>Crosscut saw operations</b>
<b>Head protection</b>	A helmet that meets NFPA 1977	Same as chain saw
<b>Eye protection</b>	ANSI Z87.1 safety glasses or equivalent (mesh bug-eye type)	Same as chain saw

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PPE	Chain saw operations	Crosscut saw operations
<b>Hearing protection</b>	Hearing protection required for gasoline-powered chain saw use	None required
<b>Hand protection</b>	Leather gloves	Same as chain saw
<b>Shirt</b>	Flame-resistant, long-sleeved shirt	Same as chain saw
<b>Pants</b>	Flame-resistant, long pants	Same as chain saw
<b>Leg protection</b>	Chaps that meet the requirements of Forest Service Specification 6170-4 and overlap your boots at by least 2 inches	None required
<b>Boots</b>	Cut-resistant or leather, laced, 8-inch-high boots that provide ankle support and have nonskid soles	Same as chain saw

#### *Ensure Proper Fit*

PPE must fit you properly and be clean and in good condition (figure 1.0.2). Accidents and injuries may result from failing to use or from misusing required PPE.

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**Figure 1.0.2—Ensure that personal protective equipment fits properly.**

**PPE guidelines:**

- **Head protection:** All helmets should be designed to provide protection from impact and penetration hazards from falling objects. Inspect shells daily for dents, cracks, signs of penetration, or any other damage that might compromise protection. Also inspect suspension systems, headbands, sweatbands, and any accessories daily.
- **Eye and face protection:** All employees require appropriate protection (including side protection) when they are exposed to eye or face hazards, such as flying particles.
- **Hearing protection:** To comply with 29 CFR 1910.95—Occupational Noise Exposure, employees must wear ear plugs, earmuffs, or both when working with equipment louder than 85 decibels.
- **Hand protection:** Ensure that hand protection is appropriate for the weather conditions. Fireline work requires leather gloves.
- **Shirt:** Long-sleeved shirts are recommended for all saw operations. Fireline work requires flame-resistant shirts for both chain saw and crosscut saw operations.
- **Pants:** Pants are required for all sawyer operations. Pants should fit comfortably but not be too loose. Fireline work requires flame-resistant pants.
- **Leg protection:** You must properly adjust chain saw chaps/pants and wear them snug to keep them positioned correctly on your legs. Chaps should provide coverage 2 inches below your boot tops. Proper fit and length maximize protection.

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- **Boots:** Chain saw use requires cut-resistant or leather boots with nonskid soles and adequate ankle support.

#### First Aid Kit

Subsection 29 CFR 1910.266(d)(2)(i)—Logging Operations mandates a first aid kit in each employee transport vehicle and at each worksite where employees are cutting trees (e.g., felling, bucking, limbing) (figure 1.0.3).



**Figure 1.0.3—First aid kit.**

The number of first aid kits and the content of each kit must reflect the degree of isolation, the number of employees, and the hazards reasonably anticipated at the worksite. At a minimum (for small sites with two to three employees) each kit must contain:

- Gauze pads at least 4 by 4 inches
- Two large gauze pads at least 8 by 10 inches
- A box of adhesive bandages (Band-Aids)
- One gauze bandage roll at least 2 inches wide
- Two triangular bandages
- Wound-cleaning agent, such as sealed, moistened towelettes
- Scissors
- One blanket
- Tweezers
- Adhesive tape
- Latex gloves
- Resuscitation equipment, such as a resuscitation bag, airway, or pocket mask
- Two elastic wraps
- Splint
- Directions for requesting emergency assistance



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Other recommended items:

- Tourniquet
- Clotting agent
- Trauma dressing

## Work Area Safety

When you enter the outdoors, you enter a dynamic environment. You can improve safety with intentional observations of the work area.

### Video: Tree Hazards and Target Avoidance

The video “Tree Hazards and Target Avoidance” is intended to help improve onsite awareness and work safety.

### A Systematic Approach to Work Area Safety

A systematic approach to work area safety begins with some definitions:

- **Work area:** The area surrounding the specific cutting operation. The sawyer establishes the size of the work area based on the site conditions.
- **Cutting area:** The zone where the sawyer can cut you with the saw. A 360-degree radius around the sawyer at a distance equivalent to the sawyer’s arm length plus the length of the tool.
- **Work area controls:** Safety procedures established by the sawyer to identify potential hazards and to plan the cutting operation.

### The Outside-In Approach

The “outside-in approach” is a systematic procedure to assess the conditions of the entire work area before engaging in the cutting operation. The goal is to observe the big picture first, starting with a wide-angle lens and then moving in, narrowing your focus to the point where you will make the cuts. Look up, down, and all around for potential hazards before moving slowly toward the center of the work area. Take your time. You can visualize the approach as a concentric circle with the big picture on the periphery, the work areas in the middle, and the cutting area at the center.

Next, we will review some examples of conditions within the “big picture,” “work area,” and “cutting area.”

The big picture (known conditions upon arrival):

- **Overall project objectives.** (Note: This is different from the specific OHLEC objective)

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- **Predominant hazards:** Standing dead trees, disease pockets, insect outbreaks, etc.
- **General surface hazards:** recent storm damage, mudslides, weather, dead and downed wood, etc.
- **General terrain:** Flat ground, rolling hills, steep slopes, etc.
- **Proximity to infrastructure:** towns, road systems, powerline corridors, etc.
- **Use level or activity:** open to the public, work projects occurring, fire activity, etc.

The work area (continued observation):

- **Observed hazards:** predominant tree lean, stand condition, wind/weather, visibility, etc.
- **Surface hazards:** loose rocks that make walking difficult, lots of stump holes, etc.
- **Terrain:** changes in slope; mostly flat, even ground; recent weather event, etc.
- **Infrastructure:** buildings, picnic tables, roads, trails, powerlines, etc.
- **People:** general public, work crews, fire personnel, etc.

The cutting area—OHLEC size-up process (observed conditions in cutting area)

- Objective of the saw operation
- **Observed hazards at the base of the tree:** broken branches, frost cracks, visible wood rot, fungi, etc.
- **Surface hazards in cutting area:** uneven ground, steep slope, poor footing, etc.
- **Cutting area terrain:** poor footing, slippery conditions, limited escape path, rocky, wet, brushy or bare.
- Human Factors

## Human Factors

It is critical to understand how thoughts and memories apply to safety.

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#### What are Human Factors?

When you are unaware of the thoughts and memories that drive your actions and decisions, your actions can have negative consequences that can create a safety hazard for you or others around you.

“Switchback” is a term used to define the thought struggle between the “fight or flight” response. This struggle can become a problem because you must manage it on the fly.

It is a natural response for your thoughts to race when you make mistakes in front of others. Adrenaline starts to flow, your heart rate increases, and you have increased reactivity and decreased awareness. This lowers your ability to take in and process information, reducing the quality of your decision making.

#### *Developing Thinking Sawyers*

**Mental toughness** is becoming aware of and monitoring your thoughts so that you know where your attention is and what is driving your decision making at any time. It is understanding how memories can put you at risk through distraction or emotional reactivity. In developing mental toughness, you learn to manage your memories and thinking to maximize cognitive function. Mental toughness requires that you understand what it means to stay in team and that you learn how to get back in team if you lose focus.

#### Video: Human Factors and the Thinking Sawyer

Watch the video, “Human Factors and the Thinking Sawyer” and then discuss it with your instructor and the class.

#### Video: How Thinking Sawyers Recover

The next video, “How Thinking Sawyers Recover,” is designed to give you tools to realize when you are not in team and what to do to get back in team.

#### Risk Management

Risk management is the deliberate action taken by an individual to manage risk by identifying hazards and threats and developing ways to mitigate and minimize the consequences. Risk management seeks to reduce risks to acceptable levels, knowing we will not be able to completely reduce all risks.

#### What is Risk Management?

Risk management is iterative, responsive to change, and intentional about processes. It incorporates learning and feedback, and explicitly addresses uncertainty. A goal of risk

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management is to develop sufficient proficiency in applying the process so that risk management itself becomes an automatic part of the decision-making process.

#### OHLEC: The Five-Step Size-up

OHLEC is a systematic, five-step size-up process during which you identify an **objective**, consider **hazards** related to the objective, determine **leans or binds** relative to the objective, develop an **escape plan**, and develop a **cut plan**. At any point during the process, your analysis may reveal conditions that cause you to reevaluate or change the objective. When the objective changes, you restart the process because a new objective may present different hazards and leans or binds, consequently requiring a different escape plan or cut plan.

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**OHLEC: Objective**

The objective is a statement about the purpose of the operation; it conveys what you intend to do (figure 1.0.4). When analyzing the objective, determine where you want the cut piece to end up:

- If felling, identify the intended lay of the tree.
- If bucking, plan where you want the bucked log or round to land.
- If limbing, determine the sequence for cutting large branches and directing their fall.
- If brushing, particularly in thick brush, plan how you will remove the brush after you cut it.



**Figure 1.0.4—A large, bucked log.**

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### OHLEC: Hazards

When implementing the OHLEC process during saw operations, identified hazards directly relate to the selected objective (i.e., where you will place the bucked log or where the tree will fall [lay] when cut). Although many hazardous conditions exist in the natural environment (figure 1.0.5), this step in the OHLEC size-up process focuses only on those hazards that directly relate to achieving the objective of the cutting operation.

Consider the following when identifying hazards:

- What is overhead (fire, rotten top, widow makers, and loose bark)?
- What is inside the wood you are cutting (fire, rot and hinge wood integrity, hollow, bar/saw length compared to diameter, bees, or poisonous plants)?
- Are there buildings, equipment, or other trees you do not want to damage?
- Are there any hazards associated with cutting area control?



**Figure 1.0.5—Hazards.**

You must control the cutting area to eliminate hazards to others. You must consider other workers or bystanders, the public, access points, and steep slopes, and should pay special attention to the proximity of swamper. The size of the area you must control depends on the operation.



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### OHLEC: Leans/Binds

You assess leans or binds to determine the type and sequence of cuts needed (figure 1.0.6). When felling, you assess the lean by the tilt of a tree away from its vertical position. In bucking, you identify and assess the binds based on the orientation of the log. Compression and tension are the two major components of a bind. Identifying the bind will help you determine your technique and procedure for bucking:

- Project the fall based on the lean.
- Predict binds based on bearing points and the lay of the log.
- Determine the reactionary forces to expect when you cut the log.



Figure 1.0.6—Assessing lean.

### OHLEC: Escape Plan

An escape plan has a minimum of two escape paths (identified as “primary” and “secondary”). To ensure your safety, you must clear both paths (to a reasonable degree) of obstructions.

Escape paths are predetermined paths where you can escape once you commit the tree to fall or buck the log.

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#### Escape Paths

With the desired felling direction in mind, determine escape paths and safety zones that lead diagonally away from the direction of the intended fall (figure 1.0.7). Consider the side of the tree where you will make your final cut and select a path that will not take you directly behind the tree.

- Look for a large, solid tree or rock for protection.
- Prepare two escape paths in case you change your location on the final cut.
- Practice using the escape paths, making sure to clear any debris that could trip you.
- Re-examine the escape paths before you begin to cut and ensure that your chosen paths will be the safest escape paths.

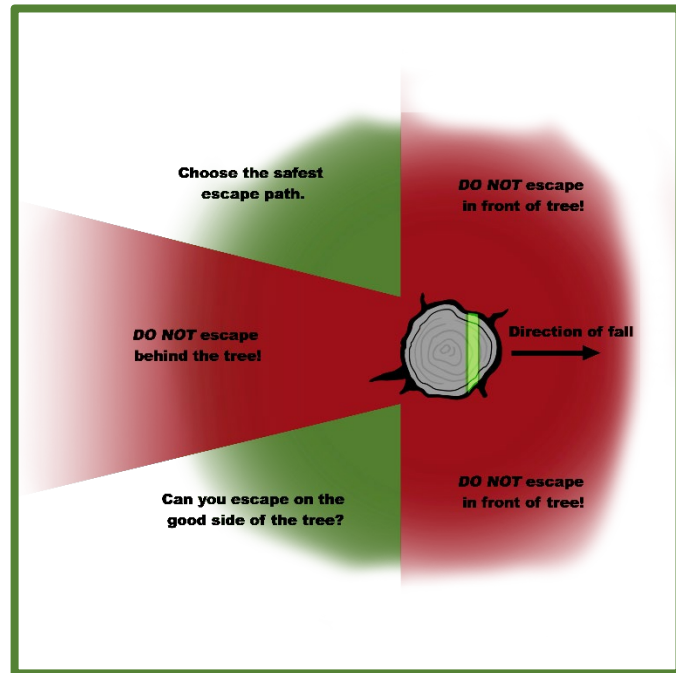


Figure 1.0.7—An escape plan.

The plans must be flexible enough to account for and adapt to the unexpected.

#### OHLEC: Cut Plan

The cut plan is the last stage of the OHLEC size-up process and determines the type and sequence of cuts that will ultimately guide the tree or log segment into the intended lay (figure 1.0.8). The results of the cut plan will determine the ultimate complexity of the operation. Your evaluation of the complexity of the assignment must be thorough and honest in order to answer the question, “Should I cut this or not?”

The cut plan accounts for the objective, hazards, leans/binds, and escape plan. It is the final step in the OHLEC size-up process, and it ties the plan together.

- Develop the cut plan for the cutting operation.
- Determine the cutting sequence.
- Determine the types of cuts required.



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If the cut plan requires the use of wedges, you must develop a wedging plan before initiating the cut.

The wedging plan, if needed, should include:

- Number, kind, and size of wedges needed
- Sequence for setting wedges



**Figure 1.0.8—Sawyers following a cut plan.**

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#### Operational Complexity

Taking into consideration all the steps you analyzed during the OHLEC size-up process, you should conduct an honest assessment of the cutting operation to determine if you have the knowledge, skills, and qualification to manage the overall complexity of the operation (figure 1.0.9).

Your evaluation of the complexity of the assignment must be thorough and honest in order to answer the question, “Should I cut this or not?” Please refer to the appendix for additional complexity tools.

	LOW	MODERATE	HIGH
O	<b>Objective</b> is easily accomplished	<b>Objective</b> may be difficult to accomplish	<b>Objective</b> is difficult to accomplish and/or high consequence of failure
H	<b>Hazards</b> are minimal and understood	<b>Hazards</b> are present and understood	<b>Hazards</b> are numerous, not totally understood and/or stable
L	<b>Leans or binds</b> do not require wedging or sequence of cuts	<b>Leans or binds</b> may require wedging	<b>Leans or binds</b> require a significant wedging plan
E	<b>Escape path</b> is clear	<b>Escape path</b> may be limited	<b>Escape path</b> is limited
C	<b>Cut plan</b> is simple	<b>Cut plan</b> requires sequence of cuts and/or wedging plan	<b>Cut plan</b> requires modified sequence and/or wedging plan

Figure 1.0.9—Operational complexity chart.

#### Putting it All Together

This module provided guidance on risk reduction, use of safety equipment, and the OHLEC size-up process (figure 1.0.10). With safety being so critical, it is imperative that you constantly survey your surroundings and seek to reduce risk as much as you can. One of the ways to accomplish this is by using the OHLEC size-up process: objective, hazards, leans/binds, escape plan, and cut plan.

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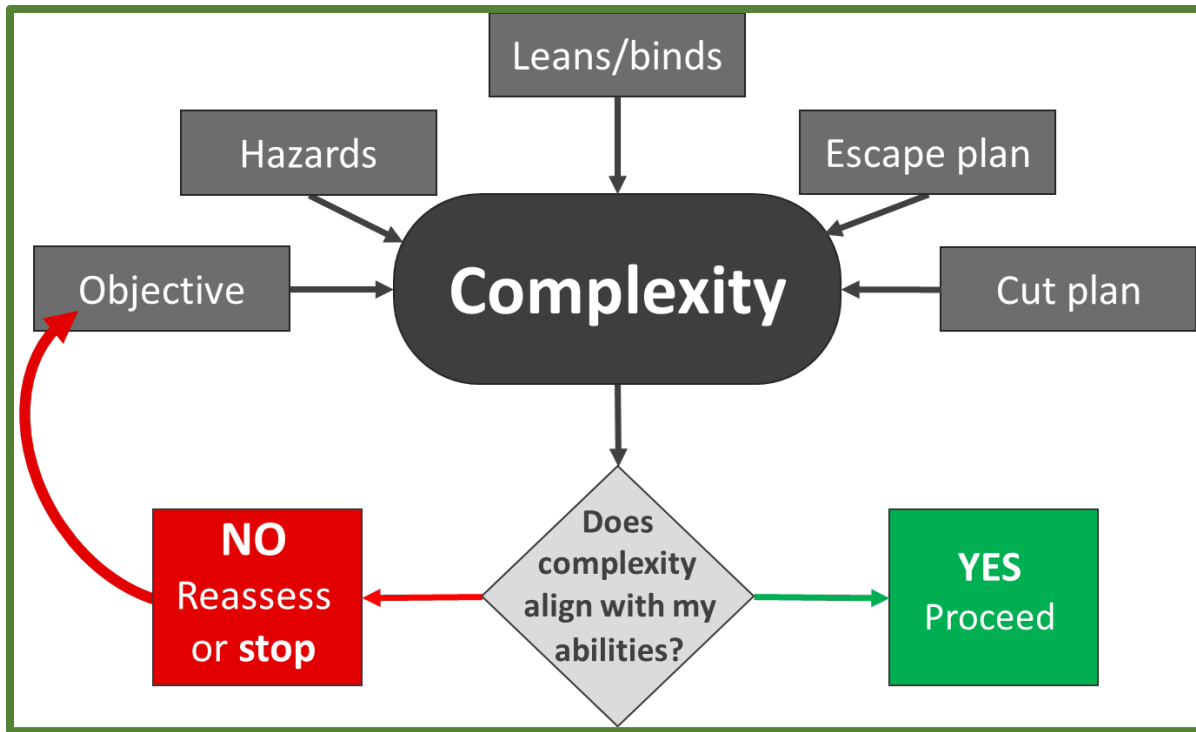


Figure 1.0.10—Operational complexity flow chart.

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**Knowledge Check**

Answer the questions below, then discuss with your instructor and classmates.

What does OHLEC stand for?

What is the difference between an escape plan and an escape path?

# USDA Forest Service National Sawyer Training:

## Developing Thinking Sawyers

### Module 1: Introduction to Saw Operations

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#### Summary

In this module, you learned to:

- Recall the guiding documents associated with the Forest Service Saw Program and policies.
- Recognize the levels of sawyer certification.
- List the three key safety concepts.
- Identify the required PPE and the proper fit for both nonfire and fire use.
- Identify and discuss how human factors affect sawyer operations.
- Identify and discuss components of the OHLEC size-up process.
- Discuss operational complexity and its relationship to a sawyer's knowledge and skill.

Do you have any questions about this introductory material, including OHLEC?

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