USDA Forest Service
National Sawyer Training:
Developing Thinking Sawyers

Instructors Guide

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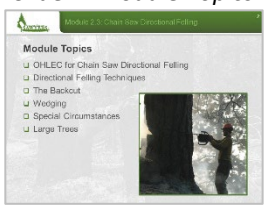
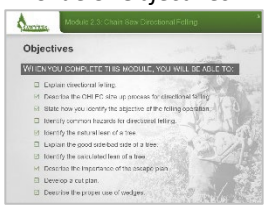
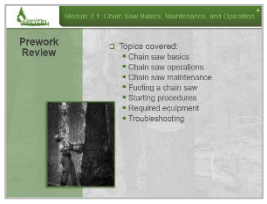
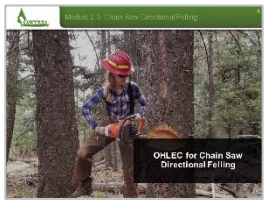
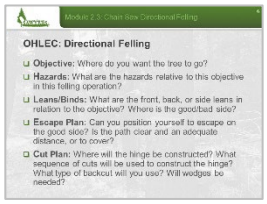
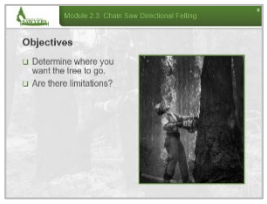
Module 2.3: Chain Saw Directional Felling

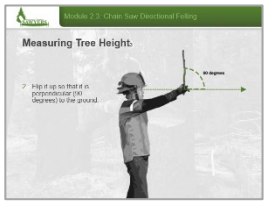
This module describes the basic concepts of how to directionally fell trees with a chain saw.

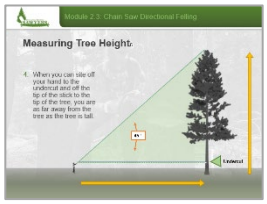
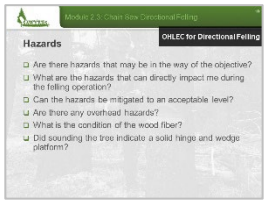
Slide/Action	Content
	## Welcome and Introduction **Time:** 143 Minutes **Note:** Do not read the slides to the students; speak in a conversational tone and use the slides to actively engage the students in two-way conversation. Add the occasional brief story or anecdote from your experience to illustrate key concepts. **DISPLAY FIRST SLIDE**
Slide 1: Chain Saw Directional Felling 	## Introduction **Say:** Welcome to Module 2.3 of the "Developing Thinking Sawyers" course. This module teaches the basic concepts of how to directionally fell trees using a chain saw. I will present concepts in the classroom and provide demonstrations. You will then practice these techniques in the field under controlled and supervised conditions. **DISPLAY NEXT SLIDE**
Slide 2: Module Topics 	## Module Topics **REVIEW** Review the module topics listed on the slide. **DISPLAY NEXT SLIDE**
Slide 3: Objectives 	## Objectives **REVIEW** Review the objectives listed on the slide. **DISPLAY NEXT SLIDE**

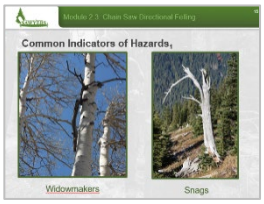
Slide/Action	Content
Slide 4: Prework Review 	## Prework Review **REVIEW** Review the topics covered in the prework packet. **Say:** We will cover and expand upon all of these topics in the classroom because they are important for safety. Please take 10 minutes to answer the review questions in your student guide. **INSTRUCTOR NOTE:** Allow students a few moments to answer the questions in the student guide, then discuss the answers. Confirm the correct answers and address any misconceptions. **Review Questions** **Q:** What is directional felling? **A:** The process of establishing a series of cuts to construct a hinge that aims and guides the tree to the ground. **Q:** What are the five steps in the OHLEC process? **A:** Objective, hazards, leans/binds, escape plan, and cut plan **Q:** How are the leans of a tree expressed? **A:** In feet. **DISPLAY NEXT SLIDE**
Slide 5: OHLEC for Chain saw Directional Felling 	## OHLEC for Chain Saw Directional Felling **Say:** **Directional felling** is the process of establishing a series of cuts to construct a hinge that guides the tree toward a specific objective (where you want the tree to go). Understanding the relationship between the undercut, the hinge, and the backcut is key to your ability to successfully direct a tree into the intended lay. **DISPLAY NEXT SLIDE**

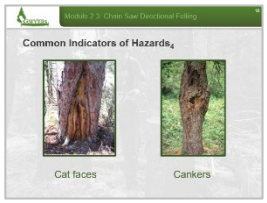
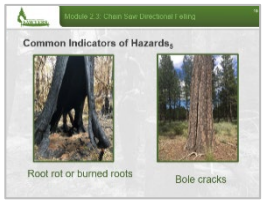
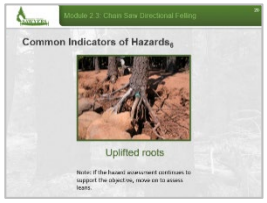
Slide/Action	Content
Slide 6: OHLEC: Directional Felling 	**OHLEC: Directional Felling** **Say:** During a felling operation, you'll consider the following during your OHLEC size-up: ▪ **Objective:** Where do you want the tree to go? ▪ **Hazards:** What are the hazards relative to the objective in this felling operation? ▪ **Leans:** What are the leans (front, back, or side) in relation to the objective? Where is the good/bad side? ▪ **Escape plan:** Can you position yourself to escape on the good side? Is the path clear and an adequate distance from the stump or to a place of cover? ▪ **Cut plan:** Where will you construct the hinge? What sequence of cuts will you use to construct the hinge? What type of backcut will you use? Will you need wedges? **DISPLAY NEXT SLIDE**
Slide 7: Video: OHLEC for Felling 	**Video: OHLEC for Felling** **Say:** We have taken an in-depth look at the OHLEC size-up process over the last few modules. Now I'd like to show you this video that pertains more specifically to felling. ***Video Debrief*** After the video, ask If there are any question. Answer any questions students may have. **Transition:** Next, we will discuss each step of OHLEC as it relates to felling. **DISPLAY NEXT SLIDE**

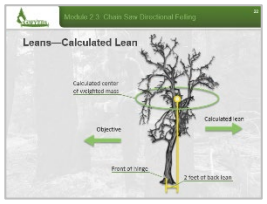
Slide/Action	Content
Slide 8: Objectives 	## Objectives **Say:** First, we'll look at identifying the objective during a felling operation. **Objective**: Where do you want the tree to go? This is the heart of directional felling. Directional felling involves developing a plan for where you want the tree to land (the objective or intended lay). This requires planning and involves multiple steps before any cutting begins. **Ask yourself:** ▪ Where do you want the tree to end up? ▪ Is the intended lay free from obstacles? ▪ Are there swamping considerations? DISPLAY NEXT SLIDE
Slide 9: Measuring Tree Height 1 	## Measuring Tree Height 1 **Say:** You can measure the height of tall objects such as trees by projecting a right isosceles triangle (a triangle with angles measuring 45, 45, and 90 degrees with two sides having the same length) using your arm, a stick, and your line-of-sight. While not necessary on every tree, knowing the height of a tree can be beneficial when felling trees around structures or other obstacles, such as fence lines, roads, or streams. Knowing the height of a tree is also beneficial for maintaining work area control. DISPLAY NEXT SLIDE
Slide 10: Measure Tree Height 2 	## Measuring Tree Height 2 **Say:** This is the procedure: **Step 1:** Hold a straight stick or an ax handle up to your cheek. DISPLAY NEXT SLIDE

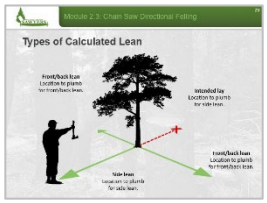
Slide/Action	Content
Slide 11: Measuring Tree Height 3 	**Measuring Tree Height 3** **Say:** **Step 2**: Flip the stick so that you're holding it perpendicular (90 degrees) to your arm. This makes a triangle in which the distance from your eye to your hand is equal to the distance from your hand to the tip of the stick. Be diligent about maintaining a 90-degree angle between your line of sight to the undercut and the stick. **DISPLAY NEXT SLIDE**
Slide 12: Measuring Tree Height 4 	**Measuring Tree Height 4** **Say:** **Step 3:** Move toward or away from the tree until you align the tip of the stick to the top of the tree and the top of your hand to the location you plan to make the undercut. **Notes:** ▪ Wherever you stand, only move your eyes to sight off your hand or the tip of the stick rather than moving your entire head. ▪ If you need to know the height of the tree in feet, you can pace the tree's height or use a loggers tape to measure the distance. ▪ This method for determining tree height works best when you stand on a similar elevation as the tree. If felling up or down steep slopes, it is best to gauge the tree's height on a sidehill first and then pace out toward the objective. **DISPLAY NEXT SLIDE**

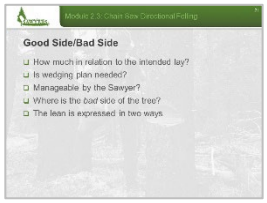
Slide/Action	Content
Slide 13: Measuring Tree Height 5 	**Measuring Tree Height 5** **Say:** **Step 4:** When you can sight off your hand to the undercut and off the tip of the stick to the top tip of the tree, you are as far away from the tree as the tree is tall. You have formed an isosceles triangle. **Note:** ▪ If you need the height of the tree in feet you can pace the tree's height or use a diameter tape to measure the distance from where you are standing. ▪ This method of determining tree height works best when on a similar elevation as the tree. If falling up or down steep slopes it is best to gauge the tree's height on a sidehill first and then pace out towards the objective. **Transition:** Next, we will consider potential hazards during our felling operation. DISPLAY NEXT SLIDE
Slide 14: Hazards 	**Hazards** **Say:** When sizing up hazards for a felling operation, think in terms of what hazards can directly impact you during the operation. Ask yourself: ▪ Are there targets that may be in the way of the objective? ▪ What are the hazards that can directly impact me during the felling operation? ▪ Can I mitigate the hazards to an acceptable level? ▪ Are there any overhead hazards? ▪ What is the condition of the wood fiber? ▪ Did sounding the tree indicate a solid hinge and wedge platform? **Transition:** Next, we will discuss common hazards and their indicators. DISPLAY NEXT SLIDE

Slide/Action	Content
Slide 15: Common Indicators of Hazards 1 	## Common Indicators of Hazards 1 **Say:** Some examples are: ▪ **Widowmakers**: Widowmakers are limbs that are no longer attached and hang loose in a tree canopy. They can fall from the canopy and potentially strike you. ▪ **Snags**: Snags are dead or dying trees that pose a risk because wind or vibration can cause them to fall unexpectedly. **DISPLAY NEXT SLIDE**
Slide 16: Common Indicators of Hazards 2 	## Common Indicators of Hazards 2 **Say:** ▪ **Loose or missing bark:** Loose bark (particularly on trees with thick bark) can pose a significant hazard if it becomes detached from the bole, falls, and strikes you. ▪ **Multiple stems or cracks at the stem/union**: Multiple stems (**schoolmarms**) can pose a risk to you due to the weak union where the stems meet and split apart. **DISPLAY NEXT SLIDE**
Slide 17: Common Indicators of Hazards 3 	## Common Indicators of Hazards 3 **Say:** ▪ **Fruiting bodies (conks)**: Fruiting bodies on the trunk or bole of a tree can be an indicator of rot. Rot can compromise the strength of the hinge and/or the wedging platform. **DISPLAY NEXT SLIDE**

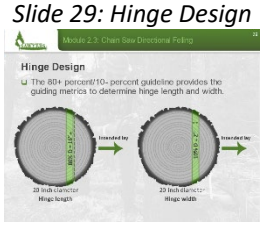
Slide/Action	Content
Slide 18: Common Indicators of Hazards 4 	**Common Indicators of Hazards 4** **Say:** ▪ **Cat faces**: A cat face is a defect that may limit the hinge location, wedging platform, or felling direction. ▪ **Cankers**: Cankers frequently occur on the stems and branches of pines and hardwoods. Canker fungi cause top-kill, branch death, or stem malformation. Stem malformations can be infected and subsequently decayed by other fungi, thus increasing the likelihood of stem breakage, especially during felling. **DISPLAY NEXT SLIDE**
Slide 19: Common Indicators of Hazards 5 	**Common Indicators of Hazards 5** **Say:** ▪ **Root rot or burned roots**: As the tree's center of gravity starts to move due to cutting, wedging, or because the tree itself is starting to fall, compromised roots can fail and the tree may fall toward its naturally weighted lean (regardless of the hinge placement). ▪ **Bole cracks**: A crack or cavity in the bole can cause the tree to break off at a weak spot above or below the defect. This is especially hazardous if the tree must push through adjacent canopies as it falls. **DISPLAY NEXT SLIDE**
Slide 20: Common Indicators of Hazards 6 	**Common Indicators of Hazards 6** **Say:** ▪ **Uplifted roots**: Uplifted roots or a majority of exposed roots are indicators of an unstable tree. The roots could fail and cause the tree to fall prematurely. **Note**: If the hazard assessment continues to support the objective, move on to assess leans. **DISPLAY NEXT SLIDE**

Slide/Action	Content
Slide 21: Leans—Natural Lean 	## Leans—Natural Lean **Say:** It is important to determine the type and amount of lean to develop the cut plan. Factors that influence lean include the location and size of limbs and the shape of the canopy. The two types of lean are natural lean and calculated lean. **Natural lean** is not relative to an objective; it is the direction that gravity would take a tree if the tree were to fall on its own. It is where the combined mass of the bole, limbs, and foliage is located relative to the center of the base of the tree. Weight distribution higher up in the tree has more influence on the natural lean than weight lower in the tree. **Transition:** Next, we will discuss calculated lean. DISPLAY NEXT SLIDE
Slide 22: Leans—Calculated Lean 	## Leans—Calculated Lean **Say:** **Calculated lean** is the amount of front-to-back and/or side-to-side lean (expressed in feet) relative to the objective. It is used to build the cutting and wedging plans that will place the tree into the objective. DISPLAY NEXT SLIDE

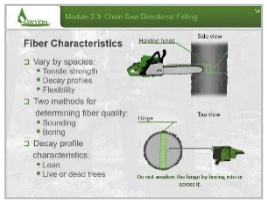
Slide/Action	Content
Slide 23: Types of Calculated Lean 	**Types of Calculated Lean** **Say:** Types of calculated lean include front-to-back lean and side-to-side lean. ▪ Determine **front-to-back lean** by standing on either side of the tree perpendicular to the objective (intended lay) and a tree length away, if possible. If the tree has back lean, you will need a wedging plan to overcome the lean or will need to change the objective. ▪ Determine **side-to-side lean** by standing in line with the objective either in the intended lay or directly opposite the intended lay. When plumbing the tree, it is most precise to be a tree length away, if possible. Beneath the side lean of the tree is considered the "bad side," as this is where the tree would fall if you fully severed the hinge. **DISPLAY NEXT SLIDE**
Slide 24: Determining Lean 	**Determining Lean** **Say:** There are many ways to determine lean. You can use a straight-handled axe, a plumb bob, or your hands. The method you use will depend on your preference and proficiency. To determine the lean of a tree, stand far enough away from the tree so that you can see the entire canopy. ▪ **When using a plumb bob**, hold the top of the string in line with the center of the top of the tree and locate the spot where the bottom of the line intersects with the ground or bole of the tree. The distance from the center of the tree is the amount of lean. ▪ **When using an ax**, hold the ax by the handle with the head down. Grasp the ax as far from the head as practical and hold it so that the ax can swing side to side. Sight down one side of the handle until it is in line with the center of the top of the tree and locate the spot on the bottom where the handle intersects with the ground or bole of the tree. The distance from the center of the tree is the amount of lean.

Slide/Action	Content
	▪ **When using your hands**, make a window by holding the index fingers and thumbs of both your hands together. Adjust your hands until you can visualize the bulk of the canopy through the window framed by your hands. Make sure the window encompasses the tips of every branch. Next, find the location where the mass of the bole, limbs, and foliage combine, then visualize splitting the mass in half by projecting a straight line to the ground. The distance from the center of the tree to the spot on the ground indicates the amount of lean. ▪ **When using your hand and a plumb bob together,** hold the plumb bob with your thumbs to eliminate visual error from the hand method. Regardless of the method you use, with some practice and experience, being able to determine a tree's lean will soon become second nature. **Note:** If the lean assessment supports your objective, move on to the escape plan. **DISPLAY NEXT SLIDE**
Slide 25: Good Side/Bad Side  	Good Side/Bad Side **Say:** • The concept of the good side and the bad side of a tree is a function of tree lean and directly relates to your safety. • The bad side of a tree refers to the side under the naturally weighted lean of the tree where a tree could fall if the hinge breaks or is unintentionally severed. • Whenever possible, you should work from the good side of the tree. **Transition:** Next, we will look at an escape plan for felling operations. **DISPLAY NEXT SLIDE**

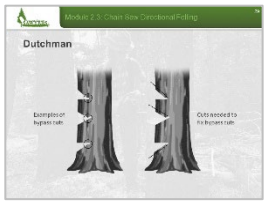
Slide/Action	Content
Slide 26: Escape Plan 	## Escape Plan **Say:** Before starting a felling operation, you must develop an escape plan. The plan should include determining and clearing an escape path and should also include an alternate path in the event that something unexpected happens. Whenever possible, you should finish cutting/wedging and escaping on the good side of the tree. Once the tree begins to fall, you should immediately move a safe distance away while keeping your attention on the falling tree and your surroundings. **Transition:** If the escape plan supports the objective and provides for your safety, continue to the cut plan. **DISPLAY NEXT SLIDE**
Slide 27: Cut Plan 	## Cut Plan **Say:** The cut plan is the last stage of the cutting operation size-up and it determines the type and sequence of cuts that will ultimately guide the tree or log segment into the objective. The cut plan accounts for the objective, hazards, leans/binds, and escape plan. The cut plan is the final step in OHLEC and is how you tie the plan elements of the size-up process together. The cut plan determines the types and sequence of cuts you will use. If the cut plan requires you to use wedges, you must develop a wedging plan before initiating the cut. The wedging plan includes the number, kind, and size of wedges needed and the sequence for setting the wedges.

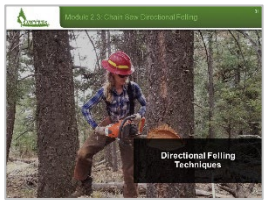
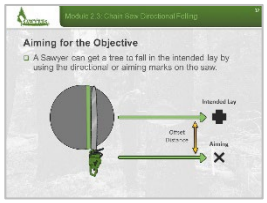
Slide/Action	Content
	It generally takes three cuts to fell a tree. Two of the cuts form the undercut, and the third cut is the backcut. The relationship between these three cuts forms the hinge, which will guide the tree into the objective. For this reason, properly constructing a hinge is critically important to any felling operation. **Transition:** Next, we will learn about the anatomy of a hinge. DISPLAY NEXT SLIDE
Slide 28: Hinge  	Hinge **Say:** There are several ways to form a hinge and fell a tree, but all follow the same basic principles and anatomy of a hinge. Here we see the undercut, the hinge, and the placement of the backcut. The length and width of the hinge aids in holding the bole to the stump as the tree falls. The fiber must be strong enough to hold the bole to the stump, yet flexible enough to bend, allowing the tree to move into the undercut as it falls into the objective. A hinge that is too wide will not bend, and the tree will be difficult to move and may require a lot of wedging. A hinge that is too thin may break and cause a loss of control. DISPLAY NEXT SLIDE
Slide 29: Hinge Design  	Hinge Design **Say:** When constructing a hinge, it is helpful to use the 80+ percent/10-percent guideline. The 80 percent refers to hinge length (distance across the stump) and the 10 percent refers to hinge width (front to back). 80+ percent/10- percent provides the guiding metrics used to initially determine the desired hinge length and width needed during a felling operation.

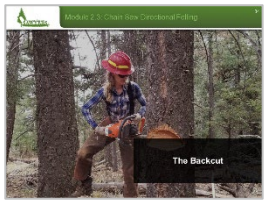
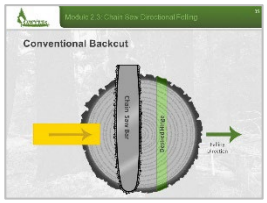
Slide/Action	Content
	You express these metrics as a percentage of the tree diameter at breast height (DBH, at 4½ ft above the ground). Targeting a minimum hinge length of 80 percent of DBH reduces the chance of over cutting the diameter of the bole and allows for a greater margin of error when trying to match cuts. You should bring the backcut, which sets the back of the hinge, forward to a point where the remaining unsevered fiber is a maximum width of 10 percent of DBH. Both these metrics depend on tree conditions; you may need to change them depending on tree species, wood fiber condition, and lean. On trees with side lean, you may need a longer hinge length (more than 80 percent) to support the weight of the tree. Hinge placement in relation to the tree diameter and center of gravity can also play a role when wedging. A hinge located more to the front of the bole will provide a longer wedging platform with more mechanical advantage. A hinge located closer to the middle of the bole will establish a shorter wedging platform and require more effort to lift the tree. ▪ **Bole shape:** The bole of a tree is seldom perfectly round. Considering the shape of the bole when placing the hinge can increase cutting efficiency by reducing the amount of cutting needed to obtain the minimum 80 percent hinge length. It can also be useful for increasing hinge holding power by locating for maximum hinge length. ▪ **Stobs:** Trees with the top broken off are called “stobs.” The challenge with stobs is that they have little to no mass or weight, so thinning the hinge in conjunction with a deeper undercut helps to fell the tree. Stobs are almost always taken with the natural lean. To fell stobs, a deeper undercut (near 100 percent hinge length) is preferable to using excessive wedging. The deeper undercut also moves the center of gravity forward (toward) the objective. **DISPLAY NEXT SLIDE**

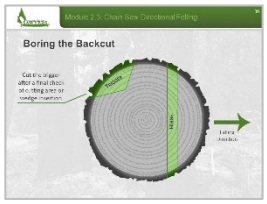
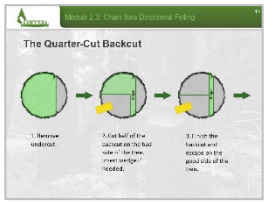
Slide/Action	Content
Slide 30: Video: Hinges 	## Video: Hinges **Say:** Let's watch this short video to get a better understanding of how the hinge works. ***Video Debrief*** Answer any questions the class may have about the information in the video. **DISPLAY NEXT SLIDE**
Slide 31: Fiber Characteristics 	## Fiber Characteristics **Say:** Fiber tensile strength and flexibility vary greatly, depending on the tree species. Knowing the characteristics of the tree fiber you are working with is critical to constructing the hinge. Another relevant consideration is the different bole decay profiles of different species. **Sounding** Sounding the tree after removing the bark can help provide you with specific hinge fiber quality information at the anticipated hinge corners. **Note:** Tree species will sound different because of their differing fiber density: ▪ A loud crack indicates sound or good fiber ▪ A softer crack or dulled thump indicates weakened, punky, or rotten fiber ▪ An echo indicates a void or hollow

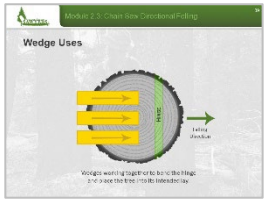
Slide/Action	Content
	Though sounding is a valuable tool, developing the skill to apply sounding knowledge effectively takes practice and experience. **Boring** Boring is the best way to verify hinge and wedging platform conditions. You should consider boring when felling standing dead trees or trees where you suspect rot. Monitor the cut chips while boring. Rotten fiber will often appear as darker brown dust that is distinctly different from the longer wood chips of sound wood. You should bore vertically and perpendicular to the hinge wood to reduce the impacts to the hinge and wedging platform. Be careful not to compromise the hinge wood. **Remember:** Observe overhead hazards and look up often! Though sounding and boring are valuable tools for the sawyer, developing the skill to apply this knowledge effectively takes practice and experience. Become familiar with decay profile characteristics and the species you work with. ▪ **Lean:** Side lean is generally more difficult to control than front or back lean. Always plan to increase hinge length with a side-leaning tree. With a front or back lean, it is generally best to design the hinge closer to 80 percent to either maximize room for wedging (neutral or back lean) or the slab size for a triangle back cut (forward lean). ▪ **Live or dead tree**: Dead fiber is generally less flexible than fiber in a live or green tree. Expect less hinge control with dead trees. DISPLAY NEXT SLIDE

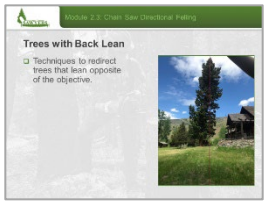
Slide/Action	Content
Slide 32: Undercuts 	Undercuts **Say:** An undercut removes the wedge section on the front part of the tree that you are felling. The undercut forms an opening (notch) in the bole to set the front portion of the hinge. An undercut made with a 45-degree opening and the sloping cut on the top is called a "**conventional undercut**." This method originally came from using axes to chop out the undercut. The "**open-face undercut"** is defined as an undercut that has an opening angle of 70 degrees or more. A wider undercut enables the tree to stay attached to the stump for longer. The "**Humboldt undercut"** has a 45-degree opening and the sloping cut on the bottom. Sawyers often use this undercut when working on steep ground. This method can also make removing large undercuts easier when felling large-diameter trees. **DISPLAY NEXT SLIDE**
Slide 33: Dutchman 	Dutchman **Say:** Regardless of the angles of the two cuts that form the undercut, you should match both cuts exactly to avoid forming a bypass (Dutchman), which could cause the hinge to break prematurely and result in the loss of control when felling. **DISPLAY NEXT SLIDE**
Slide 34: Stump Shot 	Stump Shot **Say:** The Occupational Safety and Health Administration (OSHA) requires the use of a step (stump shot) when the undercut is less than 70 degrees. You create a stump shot by making the backcut slightly above the apex of the notch. The intent is to prevent the bole of the tree from sliding back over the stump. The height of the step depends on the size and condition of the tree. **DISPLAY NEXT SLIDE**

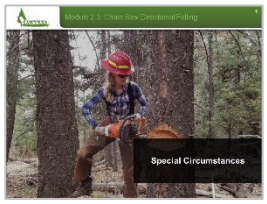
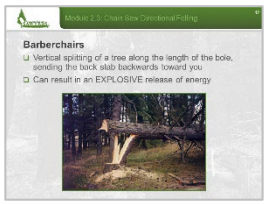
Slide/Action	Content
Slide 35: Directional Felling Techniques 	## Directional Felling Techniques **Transition:** Next, we will discuss some common techniques you will need to know for felling operations. **DISPLAY NEXT SLIDE**
Slide 36: Aiming for the Objective 	## Aiming for the Objective **Say:** Directional felling requires an understanding of right angles, powerhead design, and selecting the proper aiming location. You can achieve greater accuracy in hitting your objective by using the gunning sights of the saw to aim and line up your cuts. Gunning sights are a single line, either painted or embossed on the body of the saw, set perpendicular to the bar. To use the gunning sights properly during a horizontal cut, you must position yourself directly behind the powerhead of the saw and sight down the line toward a predetermined aiming spot. Knowing were to aim the gunning sights to hit your intended lay requires you to select a particular spot that is slightly offset from the center of the tree bole. **Example:** Assuming that a tree is straight and the top of the tree aligns with the center of the bole, observe the distance from the center of the bole to the gunning sights on the powerhead of the saw. The size of the tree bole will directly impact the distance between these two points. You will use this offset distance when selecting a point at which to aim. The point must be parallel and adjacent to the intended lay. When possible, you can increase accuracy by choosing an aiming spot that is a good distance off, beyond the point where you expect the top of the felled tree to impact. **DISPLAY NEXT SLIDE**

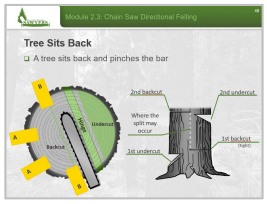
Slide/Action	Content
Slide 37: Compensating for Side Lean 	## Compensating for Side Lean **Say:** To compensate for side lean, first determine where you want the top of the tree to land, then plumb the tree to determine the amount (in feet) of side lean present. You will use this distance to offset your aim. **Example:** If the tree leans 2 feet to the **right** of the intended objective, you must face the undercut to aim the tree 2 feet to the **left** of the objective. **DISPLAY NEXT SLIDE**
Slide 38: The Backcut 	## The Backcut **Say:** The backcut is the final cut to isolate the hinge and fell the tree. There are different methods to execute a backcut. You will base the method you use on individual tree characteristics and the various conditions you may encounter. **DISPLAY NEXT SLIDE**
Slide 39: Conventional Backcut 	## Conventional Backcut **Say:** Start the backcut at the back of the tree and proceed forward toward the undercut. Make sure the cut is parallel to the front of the hinge. Pay special attention to the offside of the tree so that you do not inadvertently cut off the hinge or leave it too wide. Learn to use the saw's gunning sights to help with alignment while periodically stopping the backcut to double check your accuracy. As you progress the backcut, observe the tree and kerf for movement. Once the tree is committed to the lay, make a quick but methodical retreat using your predetermined escape path. If necessary, insert a wedge. Once you cut the hinge to the desired width, remove the saw and drive in the wedge until the tree begins to commit to the intended lay. **DISPLAY NEXT SLIDE**

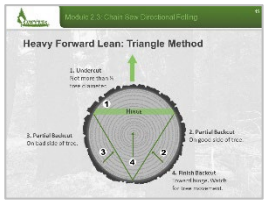
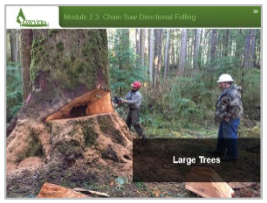
Slide/Action	Content
Slide 40: Boring the Backcut 	## Boring the Backcut **Say:** Initiate the bore cut on the near side of the tree, behind the desired hinge. The bore cut should be level across the bole. Once you have made the cut all the way through the tree, progress the cut toward the back of the hinge until you reach the desired hinge width. You may finish the boring backcut in one of two ways. Either continue the backcut directly out the back of the tree or stop short of the back, leaving a strap of wood wide enough to support the tree you are felling. This strap, or **trigger**, will support the tree, giving sufficient time for you to perform a final check of the cutting area or to insert wedges into the backcut. When you're ready, cut the trigger. Once the cut is complete and the tree begins to move, use your escape path. **DISPLAY NEXT SLIDE**
Slide 41: The Quarter-Cut Backcut 	## The Quarter-Cut Backcut **Say:** You can use the quarter-cut backcut when a tree has side lean or back lean, or when the chain saw bar is not long enough to reach across the tree. The quarter cut facilitates the use of wedges on small-diameter back-leaning trees. The key is to remove only a portion of the backcut at a time, allowing you to insert a wedge into a relatively stable tree. **INSTRUCTOR NOTE:** Please use the "Saw Station Guide" in appendix A for a walkthrough of the "notch and backcut construction" saw stations that will allow students to practice a variety of backcuts. **DISPLAY NEXT SLIDE**

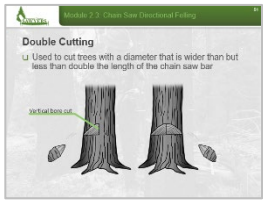
Slide/Action	Content
Slide 42: Wedging 	## Wedging **Say:** Sawyers use wedges to drive a kerf apart and guide the bole of the tree into the objective. A sawyer typically carries three or more wedges, depending on the task at hand. **DISPLAY NEXT SLIDE**
Slide 43: Wedge Uses 	## Wedge Uses **Say:** As you drive a wedge into the kerf, the force developed effectively lifts the back of the tree and moves (rotates on the hinge) the top of the tree forward. This redistributes the center weight of the tree forward into the objective. To facilitate this movement, you should time the cadence of your strikes with the forward rocking of the tree. Take special care to watch for limbs, bark, or tops which you may have knocked loose. In situations where you need more than one wedge to overcome back lean, stacking wedges becomes necessary. When you stack two 1-inch wedges, you double the amount of lift. It is a common practice to put sawdust between the wedges to lessen the likelihood of a wedge **shooting** out when struck. We cover stacking wedges in more detail in Module 6. **DISPLAY NEXT SLIDE**

Slide/Action	Content
Slide 44: Stabilizing Wedges 	Stabilizing Wedges **Say:** On trees with side lean, when using a quarter or boring backcut, you can place a stabilizing wedge parallel to and behind the hinge. This can prevent the hinge from failing due to the side weight of the tree. Only snug this wedge; do not pound on it or it may break the hinge. The theory is to support the hinge and not **lift** the side of the tree. Depending on the amount of side lean and the support needed, you can insert additional wedges. **Indicator Wedge** You can place a wedge in the kerf of the backcut to help you visualize tree movement (known as an "indicator wedge"): ▪ As soon as possible, place just the tip of the wedge into the kerf. ▪ Continue with the backcut. A wedge that begins to drop indicates that the kerf is starting to open and the tree is beginning to fall. DISPLAY NEXT SLIDE
Slide 45: Trees with Back Lean 	**Say:** You can use wedges and cutting techniques to redirect trees that lean opposite the intended felling direction. Wedges lift the back of the tree and redistribute the weight or center of gravity of the tree toward the undercut. In general, once you initiate a backcut and there is sufficient room, you will insert a wedge. After you have carried out the backcut to the desired point, you can remove the saw and strike the wedge until the tree begins to fall. When felling trees with back lean, it is very important to realize that you will be operating from the bad side of the tree for most of the felling process. Remember to factor in this consideration when you reassess your plan with the OHLEC size-up process. DISPLAY NEXT SLIDE

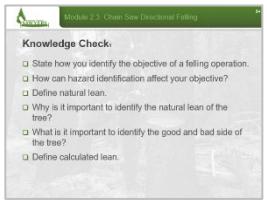
Slide/Action	Content
Slide 46: Special Circumstances 	## Special Circumstances **Say:** Special circumstances can add complexities to felling operations. The following slides provide information about some methods for felling trees with additional complexities. **DISPLAY NEXT SLIDE**
Slide 47: Barberchairs 	## Barberchairs **Say:** A barber chair is an explosive release of wood fibers under tension. It results in a vertical split of the tree bole: ▪ The dynamic splitting motion launches the straightening fiber slab upward and/or outward from the bending fiber in an uncontrolled release of energy. This can sometimes completely sever the stem and even throw the freed slab many feet away from the original stump location. ▪ It is very difficult to develop an escape plan for a barberchair. ▪ Heavy, forward-leaning trees, the presence of a Dutchman, or a poorly constructed undercut can cause a tree to barberchair. **Considerations/Mitigations** Reducing the amount of wood fiber under tension will reduce the likelihood of a barberchair. Two methods for reducing wood fiber under tension are: ▪ The boring backcut ▪ The triangle method **Note:** We will discuss the triangle method again shortly. **DISPLAY NEXT SLIDE**

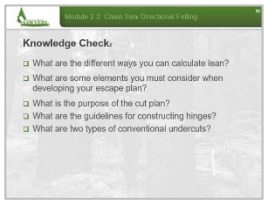
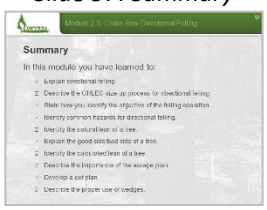
Slide/Action	Content
Slide 48: Tree Sits Back 	**Tree Sits Back** **Say:** Sometimes when you are completing a backcut, the tree sits back and pinches the bar. This can occur because: ▪ You misjudged the tree's lean. ▪ A wind gust pushes the tree backward. ▪ The tree bole has hidden rot. ▪ You failed to insert a wedge early enough. If the tree is large enough and sufficient hinge wood remains, you can sometimes wedge the tree over into its objective. Insert wedges into position A (if possible) and drive them until the tree lifts. If there is no room for wedges in position A, place wedges in position B and alternate striking them until the tree lifts. Sometimes, in situations where you have misread the lean and have not inserted wedges, the tree sits back heavily enough that you cannot insert wedges into position A. In these situations, you can refell the set-back tree, even into the opposite direction. Your first option in these situations should be to seek advice from a more experienced sawyer. If you decide to refell a set-back tree, you must be extra cautious while working on and around it. **Important**: Since the felling plan has changed from the original objective, you must reevaluate the situation using the OHLEC size-up process. If you are going to back-fell the tree, remove the powerhead from the saw so that, if something goes wrong, you won't smash your saw. DISPLAY NEXT SLIDE

Slide/Action	Content
Slide 49: Limb Tied Trees 	## Limb Tied Trees **Say:** Trees grown close together and with limbs intertwined often need to be felled together. If you cannot see all the limbs, assume that they are interlocked and fell the trees together: ▪ Using standard undercut and backcut techniques, execute the cuts and place a wedge in the backcut. ▪ Once you prep the first tree, be extremely cautious while working on the second tree. ▪ Without turning your back, use a standard undercut and backcut technique to create a hinge that aims the second tree in the same direction as the first tree (hinges are parallel). ▪ When ready, release the second tree, allowing both trees to fall together. **DISPLAY NEXT SLIDE**
Slide 50: Heavy Forward Lean: Triangle Method 	## Heavy Forward Lean: Triangle Method **Say:** The triangle and boring backcut methods reduce the amount of wood fiber under tension and therefore lessen the potential for a tree to barberchair. We already discussed the boring backcut method on slide 33. Let's look at the steps for the triangle method: ▪ Construct an undercut without pinching the bar. ▪ Make a partial backcut on both sides of the tree, forming a triangle-shaped piece of uncut wood. If the tree has side lean, cut the compression side first. ▪ Finish the backcut toward the hinge, watching for tree movement. ▪ When the tree begins to fall, follow an escape path to safety. **DISPLAY NEXT SLIDE**
Slide 51: Large Trees 	## Large Trees You may often need to fell trees with a wider diameter than the chain saw bar. You can use the methods in the following sections when you encounter these trees. **DISPLAY NEXT SLIDE**

Slide/Action	Content
Slide 52: Double Cutting 	**Double Cutting** **Say:** Double cutting is a technique sawyers use to cut trees that have a diameter wider than the length of the chain saw bar. This method requires you to make the undercut using two horizontal cuts and two sloping cuts from opposite sides of the tree. Depending on the size of the undercut you remove, it may be necessary for you to vertically bore into the undercut. This connects the sloping and horizontal cuts and enables you to remove the first half of the undercut before going to the other side of the tree and removing the second half of the undercut. **DISPLAY NEXT SLIDE**
Slide 53: Trees More Than Twice as Wide as the Chain Saw Bar Length 	**Trees More Than Twice as Wide as the Chain Saw Bar Length** **Say:** To make felling cuts on a tree with a diameter that is more than twice the length of the chain saw bar: ▪ Cut a large and open undercut to create room for the powerhead in the undercut notch. ▪ Bore in and cut a recess into the center of the undercut. ▪ Using a boring backcut, first set the hinge width on one side of the tree. ▪ Saw around the rest of the tree, inserting a wedge in the back. ▪ Finish the backcut, leaving the proper hinge width. **INSTRUCTOR NOTE:** Please use the “Saw Station Guide” in appendix A for a walkthrough of the “felling a tree” saw station that will help students to practice calculating leans, measuring tree height, constructing a hinge, etc. **DISPLAY NEXT SLIDE**

Slide/Action	Content
Slide 54: Operational Complexity: Putting it all Together 	**Operational Complexity: Putting it All Together** Complexity is defined as: "A characterization of the cutting operation and the elements the sawyer will have to manage while implementing it. The complexity will also determine the level of knowledge, skill, experience, and certification a sawyer will need." Complexity is not managing the risks of the operation, but rather how you manage all aspects of the sawing operation. While determining complexity is subjective, it is one of the most important processes for you to understand and implement. **Example:** Managing the complexity of a cutting operation is like driving a car. Many different elements influence the complexity of a driving situation: ▪ Is it sunny, raining or snowing? ▪ Is it nighttime or daytime? ▪ Is the vehicle in good working condition? ▪ Is it rush hour or light traffic? The driver's decision of where and when to drive can be highly variable, but the driver must make an honest assessment of the situation and decide whether to proceed. **As a sawyer, you must do the same thing.** Once you complete the OHLEC size-up process, you must determine whether you have the knowledge, skill, and experience, to manage the complexity of the cutting operation. If the complexity does not align with your abilities, go back and reassess your objective. Even if you think you have the knowledge and experience to implement the cut plan, now is also the time to do a gut check to make sure your head is in the game. Consider seeking mentorship from a more experienced sawyer. DISPLAY NEXT SLIDE

Slide/Action	Content
Slide 55: Knowledge Check 1 	## Knowledge Check 1 Allow students a few moments to answer the questions in the student guide. Discuss the answers and correct any misconceptions. **Q:** How do you identify the objective of the felling operation? **A:** By determining your intended lay (where you want the tree to go). **Q:** How can hazard identification affect your objective? **A:** Identifying and mitigating potential hazards is necessary for your safety and for achieving your objective. **Q:** Define natural lean? **A:** Natural lean is the direction that gravity would take the tree if it fell on its own. **Q:** What is the importance of identifying the natural lean of the tree? **A:** To determine the good side and bad side of the tree. **Q:** Define calculated lean. **A:** Calculated lean is the amount of front-to-back and/or side-to-side lean. **DISPLAY NEXT SLIDE**

Slide/Action	Content
Slide 56: Knowledge Check 2 	## Knowledge Check 2 **Q:** What are the different ways you can calculate lean? **A:** By using a plumb bob, an ax, your hands, or a plumb bob/hand combination. **Q:** When developing you escape plan, what are some elements that you must consider? **A:** Answers should include: ▪ Minimum of two escape paths ▪ Safety zones/protection ▪ Flexibility ▪ Preidentified good side/bad side of the tree ▪ Paths are clear of debris **Q:** What is the purpose of the cut plan? **A:** To construct the hinge that will guide the tree to the objective. **Q:** What are the guidelines for hinge construction? **A:** The 80+ percent/10- percent guideline. **Q:** What are two types of conventional undercuts? **A:** Conventional and open face. **DISPLAY NEXT SLIDE**
Slide 57: Summary 	## Summary **REVIEW** Review the summary objectives listed on the screen. **DISPLAY NEXT SLIDE**
Slide 58: Questions? 	## Questions **Say:** Are there any questions about directional felling using a chain saw?

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