USDA Forest Service
National Sawyer Training:
Developing Thinking Sawyers

Instructors Guide

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Module 4: Ax Basics, Maintenance, and Use

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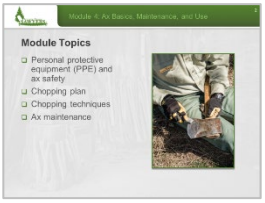
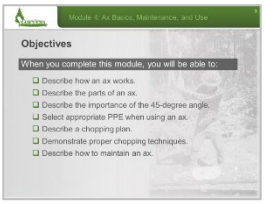
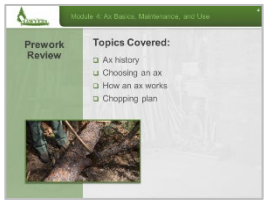
	## Welcome and Introduction **Time:** 103 minutes **Note:** Do not read the slides to the students, speak in a conversational tone and use the slides to actively engage them in a two-way conversation. Add the occasional brief story or anecdote from your experience to illustrate key concepts. **DISPLAY FIRST SLIDE**
Slide 1: Ax Basics, Maintenance, and Use 	## Introduction **Say:** Welcome to Module 4 of the "Developing Thinking Sawyers" course. This module is an introduction to selecting and properly using an ax. I will present concepts in the classroom and will follow up with 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 topics listed on the slide. **TRANSITION** Now we will review the objectives we have for this module. **DISPLAY NEXT SLIDE**
Slide 3: Objectives 	## Objectives **REVIEW** Review the objectives listed on the slide. **DISPLAY NEXT SLIDE**

Slide 4: Prework Review



Prework Review

REVIEW

Review the topics covered in the prework packet.

Say:

Some of these topics we will cover again here in the classroom because they are important for safety or have more details you need to know. The rest we will review now.

INSTRUCTOR NOTE:

Allow students a few moments to answer the questions in the student guide, and then discuss the answers. Confirm the right answers and correct any misconceptions.

Review Questions

Q: What are the three main types of axes used today?

A: Double-bit ax, single-bit ax, boy's ax.

Q: How do you decide on the appropriate handle length?

A: Your level of experience, the task at hand, and your height.

Q: What are some important considerations when selecting an ax?

A: Handle length, ax head weight, properly shaped and sharpened ax bit, type of use, handle well fitted to the eye.

Q: Why is the 45-degree chopping angle important?

A: A 45-degree angle is the optimum angle for severing fibers and removing chips. Swinging an ax at a 45-degree angle slices and splits wood along its grain. An angle shallower than 45-degrees will glance off the log in a dangerous fashion. An angle steeper than 45-degrees will not slice and split the wood and would be a very inefficient use of an ax.

Note:

Tree diameter may necessitate a longer ax handle. To have maximum control of the ax, the arm's length guideline is a great starting point for determining ax handle length.

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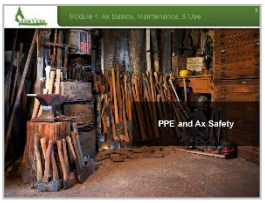
	TRANSITION Proper equipment and techniques are your first step towards protecting yourself and others. **DISPLAY NEXT SLIDE**
Slide 5: PPE and Ax Safety 	## PPE and Ax Safety **Say:** Personal protective equipment (PPE) is a requirement that helps protect sawyers from injuries. **DISPLAY NEXT SLIDE**
Slide 6: Required PPE 	## Required PPE **Say:** An ax can easily chop through pants, chain saw chaps, or boots. The best way to protect yourself is to be aware of your surroundings and to use proper chopping form. The required PPE to wield an ax includes long pants, sturdy leather boots, eye protection, long sleeves, and a helmet. **READ SLIDE CONTENT** **INSTRUCTOR NOTE:** If someone asks about hand protection, you can discuss the policy below: The Forest Service hand protection policy states: "Supervisors shall select and require employees to use appropriate hand protection (71.13, ex. 01) when employees' hands are exposed to hazards, such as those from skin absorption of harmful substances; severe cuts or lacerations; severe abrasions; punctures; chemical burns; thermal burns; and harmful temperature extremes." Some interpret this policy to mean that gloves are required when chopping with an ax, while others argue against it. The truth is both

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	positions have merit. Having conversations like this with your work group, supervisor, and others is an important part of risk informed decision making. These conversations should be the basis for developing a job hazard analysis (JHA), risk assessment worksheet (RAW), or other safety-related standard operating procedures. It is easy to argue that PPE that does not fit correctly, is worn, dirty or in disrepair, or that inhibits other functions such as dexterity and grip, can subject the user to a greater potential for injury. If you wear gloves while swinging an ax, it is important they have a snug fit, allow for good manual dexterity, and provide a solid grip. There are form-fitting gloves made of various materials available on the market that will ensure all these important factors are maintained. However, these alternatives often come at a higher price, are not a one-size-fits-all, and may be more difficult to obtain. Wearing standard leather gloves is a requirement when sharpening an ax bit. **TRANSITION** Proper techniques and safe handling are your first line of defense against injuries. **DISPLAY NEXT SLIDE**

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Slide 7: Chopping Techniques and Safety 	**Chopping Techniques and Safety** **Say:** In this module, I will present several chopping techniques that cover a variety of situations. Gaining an understanding of how to perform these techniques and accomplish a job safely and efficiently begins with proper chopping form and handling. Taking the time to clear and prepare your work area before chopping is a must. When you apply a few general principles to all your chopping techniques, you help to ensure a safe, efficient, and effective operation. **TRANSITION** Preparing your work area, proper chopping form, and appropriate PPE are only part of ax safety. Focusing on the operation and how you are using the ax will help ensure your safety. **DISPLAY NEXT SLIDE**
Slide 8: Chopping Plan 	**Chopping Plan** **Say:** Ax work incorporates three elements: having a properly tuned ax that fits your body, swinging an ax with power and accuracy, and deciding how and where to chop. This decision is known as the chopping plan. Knots are very hard to sever, binds add complexity, footing can make some locations inaccessible, and you may need to employ different techniques to chop through larger logs. **TRANSITION** Proper delivery of the bit into the wood makes an ax a very efficient tool. **DISPLAY NEXT SLIDE**

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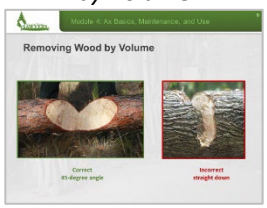
Slide 9: Removing Wood by Volume 	## Removing Wood by Volume **Say:** A saw cuts on a two-dimensional plane, but when using an ax, the task becomes three-dimensional as the ax removes wood chips in volume. For an ax to remove wood chips, the bit of the ax slices through wood fibers, splitting the wood along the grain and allowing chips to pop out from the log. The **face** is the opening where the ax has removed the chips. When properly done, the ax user will form two faces in the log by chopping on both the left and right sides of the planned point of separation, which will construct a "V." **TRANSITION** So how do we split the wood along the grain? **DISPLAY NEXT SLIDE**
Slide 10: Ax Angle 	## Ax Angle **Say:** Swinging an ax at a 45-degree angle slices and splits wood along its grain. The diagram in figure 4.0.6 shows how a 45-degree angle is the optimum angle for severing fibers and removing chips. An angle shallower than 45-degrees will glance off the log in a dangerous manner. An angle steeper than 45-degrees will not slice and split the wood and would be a very inefficient use of an ax. **TRANSITION** Using a 45-degree angle will allow you to construct a free face and effectively remove wood chips. **DISPLAY NEXT SLIDE**

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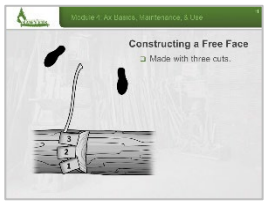
Slide 11: Constructing a Free Face 	## Constructing a Free Face **Say:** An ax user typically makes the **free face** with three cuts: 1. The first cut chops the far side of the log. 2. The second cut overlaps the first cut and is in the middle of the log. 3. The third stroke overlaps the second cut near the other side of the log. As the ax bit severs wood fibers the cheeks of the ax split the wood to the constructed free face. This combination of severing and splitting is why it is important to strike the log at a 45-degree angle. **TRANSITION** Next, we will look at different chopping plans. **DISPLAY NEXT SLIDE**
Slide 12: Chopping From Both Sides 	## Chopping From Both Sides **Say:** When possible, it is more desirable to cut the log from two sides. Chopping a log from both sides reduces the amount of wood you must remove and the time it takes to complete the task. This figure shows how chopping a log from both sides and lining up the two cuts to meet in the middle removes one-third of the amount of wood than does cutting from only one side of the log. Slightly offsetting the notches facilitates severing the log on the final blow. **DISPLAY NEXT SLIDE**

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Slide 13: Chopping From One Side 	## Chopping From One Side **Say:** Imagine that you come across a log that is 15 inches in diameter. To cut through the log chopping from one side only, you will need to chop twice the diameter of the log. For this log, that would be 30 inches. Chopping from both sides reduces the width of the cuts to 15 inches on both sides. If you choose to chop from only one side of the log, the cuts you must make would be **twice the log diameter apart**—or 30 inches apart. Popping out chips from a log making cuts 30 inches apart is almost impossible, so you need to start smaller. **TRANSITION** There are two different methods to create a notch wide enough to chop through a log this size. **DISPLAY NEXT SLIDE**
Slide 14: Chopping Large Logs—Connecting Notches 	## Chopping Large Logs—Connecting Notches **Say:** The first method is to make two smaller notches and then connect them as shown here. As you can see, the ax user makes two smaller notches and then connects the two notches by splitting the wood in between them to get through the log. **DISPLAY NEXT SLIDE**

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Slide 15: Chopping Large Logs—Increasing Notch Size 	## Chopping Large Logs—Increasing Notch Size **Say:** The second method is to start a notch and cut until the two sides or faces have closed. Then open the notch wider by chopping on one side of it. The ax user can repeat this process as many times as needed to sever through the log. **Note:** Throughout the rest of this module, **faces** refers to the two sides of a cut. **DISPLAY NEXT SLIDE**
Slide 16: Standing on the Log 	## Standing on the Log **Say:** When bucking a downed log that rests on or near the ground, chopping from both sides while standing on top is often the most efficient way to operate. Standing on top of a log and chopping equal sized notches from both sides that connect in the middle allows the ax user to remove the smallest amount of wood yet still fully sever the log. When this is the case, you may choose to cut footholds into the log, so you have a flat place to stand. **TRANSITION** As you mentally develop your chopping plan, you need to consider the chopping techniques you will be using to ensure the safest and most efficient swing possible. **DISPLAY NEXT SLIDE**
Slide 17: Chopping Techniques 	## Chopping Techniques **Say:** There are two basic chopping techniques—swinging overhead or swinging over your shoulder. Your preferred style will be based on your comfort level and the type of chopping that you do. However, to master the use of an ax, you must master both the overhead and the over-the-shoulder chopping techniques. **DISPLAY NEXT SLIDE**

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Slide 18: Two Types of Chopping Techniques 	## Two Types of Chopping Techniques **Say:** The overhead technique works best for chopping horizontal logs because the power for swinging an ax is in the center of the body. As you swing an ax down toward the log, the overhead style delivers the most precise and powerful chop. It is also the most accurate technique because you are looking directly down at the log as you chop. However, if the terrain prevents you from effectively positioning your body for the overhead swing, the over-the-shoulder technique may work better. Whether you chop from overhead or over your shoulder, everyone has a dominant side. It is important to be able to chop either left- or right-handed, even though most people instinctively prefer their dominant side. While an ax user may exclusively swing an ax using their dominant side in an overhead chop, a proper over-the-shoulder chop requires swinging the ax both left- and right-handed. Also, many limbing tasks require ambidextrous use of an ax. For these reasons, it is important to practice both left- and right-handed use of the ax from the beginning of your training. Regardless of which chopping technique you use; accuracy is more important than power. Practice accuracy and gradually add more power to your swing. You can use a simple exercise to improve your hand-to-eye coordination when chopping: ▪ Focus on a specific spot on a log and use the over-the-shoulder and overhead styles to try to strike that exact spot with the ax as many times as you can. This will help improve precision and accuracy. ▪ Aim directly between your arms when using the overhead style. **DISPLAY NEXT SLIDE**

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Slide 19: Overhead Chop 	## Overhead Chop **Say:** Ax users generally prefer the overhead chopping technique. The overhead chop delivers the ax to the log with the most power and accuracy. The overhead technique pictured here allows the ax user to swing with their dominant hand on both sides of the log. Because the overhead chop follows the body's bilateral symmetry, it is the most accurate and powerful chopping method. Many novice ax users have a bad habit of looking off to the side or around the ax to gauge accuracy. To prevent this, envision resting your chin on the center of your chest during the downward stroke. If you align your body correctly from your feet through your hips and shoulders, you will raise the ax properly and follow through to cut on your mark, preventing a glancing blow that might injure you. **TRANSITION:** Your student guide lists the seven overhead chopping steps for reference after this class. **DISPLAY NEXT SLIDE**
Slide 20: Video: Overhead Chop 	## Video: Overhead Chop **PLAY VIDEO** After the video, discuss the following: **Q:** What are the main benefits of the overhead chop? **A:** Power and accuracy. **Q:** What is a drawback of the overhead chop? **A:** You need good footing around the log you are chopping. **TRANSITION** Despite the acute advantages to the overhead chop, field conditions, such as the terrain and the position of the log, often do not allow you to chop in this style exclusively. When you are cutting on steep sidehills or in situations where the log is elevated or angled with the

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	contour of the slope, you must use the over-the-shoulder or ambidextrous chop. **DISPLAY NEXT SLIDE**
Slide 21: Over-the-Shoulder Chop  	## Over-the-Shoulder Chop **Say:** For an over-the-shoulder chop, maintain an athletic stance, and as much as possible, keep the ax in a single plane with your shoulders engaged and forward facing. To achieve this, you must chop left-handed on the left side of the face and right-handed on the right side of the face. This requires you to chop well with your nondominant side, which demands considerable experience. Practice the over shoulder chop with both hands from the early stages of training. If you achieve this basic form, the ensuing swing should commence naturally. It is more difficult to achieve the whip-like motion of the body in this position, making the culminating snap of the wrist even more important. **TRANSITION** Next, we will watch a short video detailing the steps for an over-the-shoulder chop. **DISPLAY NEXT SLIDE**

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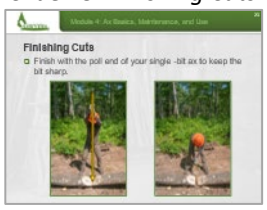
Slide 22: Video: Over-the-Shoulder Chop 	**Video: Over-the-Shoulder Chop** **PLAY VIDEO** After the video, discuss the following: **Q:** What are the main benefits of the over-the-shoulder chop? **A:** An ax user can use it with uneven or difficult footing. An ax user can strike at almost any angle, so it is great for limbing, bucking, and chopping out undercuts. **Q:** What is a drawback of the over-the-shoulder chop? **A:** This technique is more difficult to master because it requires using right-and left-handed swings. **TRANSITION** To keep a functional tool in the woods, you need to be very careful to only hit wood with your ax. Next, we will look at how to complete finishing cuts that only strike wood. **DISPLAY NEXT SLIDE**
Slide 23: Finishing Cuts 	**Finishing Cuts** **Say:** Damage to the ax can happen when an ax user misses the intended mark or swings completely through a log and strikes something on the other side unintentionally. The single-bit ax is the best companion to the crosscut saw because the sawyer can use it to drive wedges. A single-bit ax only has one finely tuned edge and the poll of the ax. Therefore, to prevent damage to the bit of the ax, you will typically finish severing a log with the poll end of the ax. To do this, first chop through the log until you have almost fully severed it. Then switch to the poll end of the ax and use the overhead chop to strike down through the center of the cut and break the log in two. **DISPLAY NEXT SLIDE**

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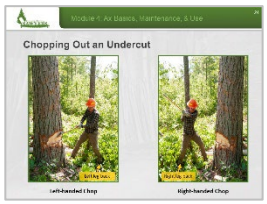
Slide 24: Chopping Out an Undercut 	## Chopping Out an Undercut **Say:** During felling operations and in complex bucking situations, you will need to chop on a vertical or near-vertical log. Use an over shoulder chop in these situations. When chopping on a vertical log, the risk of a glancing blow and the ax striking you is higher. ### *Chopping Out an Undercut Steps* 1. Spread your feet apart in an athletic stance with your toes pointed roughly 90-degrees apart. 2. For a right-handed chop, your right leg should be back and away from the tree. For a left-handed chop, your left leg should be back and away from the tree. Keeping the respective leg back allows you to base your power off that leg and positions your body so that if a glancing blow was to happen, you are in a safe place where the ax will not strike you. 3. Raise the bit over your shoulder in a smooth, unrushed manner. The poll of the ax should almost touch your shoulder. 4. As you wind up the swing, keep your wrists at 90-degree angles to the ax handle. 5. For a right-handed chop, your left elbow will almost straighten entirely, while your right elbow will be bent. 6. Striking at a 45-degree angle from over your shoulder to the impact point on the tree will allow the ax to enter the tree efficiently and safely, thus severing fibers and popping out chips. **DISPLAY NEXT SLIDE**

Slide/action	Content
Slide 25: Limbing 	Limbing **Say:** An ax is an efficient tool for removing limbs from downed trees. Removing limbs with an ax often takes one or two swings and is much more efficient than limbing with a handsaw. Limbing with an ax is an inherently dangerous task because you will be chopping overhead and over your shoulder on many different planes. Always planning your follow-through swing in a manner that keeps you and the ax safe is imperative in limbing operations. When limbing, chop the limbs at a 45-degree angle. Chopping the limb on the side of the log opposite from where you are standing is the safest way to limb. This is not always possible due to topography and other obstacles, but it is always possible to have a safe follow through when limbing. **TRANSITION** We will now watch a video about limbing. **DISPLAY NEXT SLIDE**

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Slide 26: Video: Limbing With an Ax 	**Video: Limbing With an Ax** **PLAY VIDEO** Watch the video and then ask the students the questions below: **Q:** When limbing, sawyers always need to have a safe _____ on their ax swing. **A:** Follow-through. This is so the bit of the ax cannot strike the sawyer. **Q:** What are three ways to safely limb a tree? **A:** 1. Chop on the opposite side of the log. 2. Stand on top of the log. 3. Remove limbs on the same side of the log as your body, but do not swing towards yourself. **TRANSITION** We have discussed chopping design, different techniques, and how to use both to your advantage. Next, we will discuss the maintenance of your ax. **DISPLAY NEXT SLIDE**
Slide 27: Ax Maintenance 	**Ax Maintenance** **Say:** Axes are a necessary tool for sawyers, so it is important to keep them in the best condition possible. Proper maintenance of your ax will not only extend the life of the ax but will also help to keep you safe. **DISPLAY NEXT SLIDE**

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Slide 28: Maintenance 	Maintenance **Say:** Most experienced ax users carry a small honing stone to sharpen the cutting edge. If you spend much of your day chopping, hone the edge as needed. Next, clean any dirt or sap off the ax head. Any petroleum-based or citrus-based solvent, isopropyl alcohol, or cleaner works. If you do not want to use a solvent, you can use a razor scraper, steel wool, or sandpaper. When working in wet areas, dry off the ax at the end of the day before you put it away. If you are storing your ax in the woods at the end of the day, remove the sheath. Sheaths become wet in the field and hold moisture against the bit, thus causing rust to form overnight. After cleaning an ax head, apply a light coat of oil to preserve the head and prevent rust. Treat the handle with linseed oil as needed. An adage for applying linseed oil to a new ax handle is apply once a day for a week, once a week for a month, once a month for a year, and once a year forever For more in depth information on ax maintenance refer to the publication “One Moving Part: The Forest Service Ax Manual.” **DISPLAY NEXT SLIDE**

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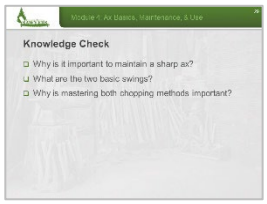
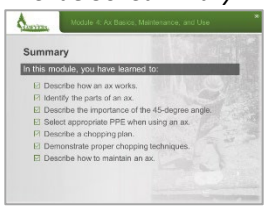
Slide 29: Knowledge Check 	## Knowledge Check **Ask:** Allow students a few moments to answer the questions in the student guide. Discuss the answers and correct any misconceptions. **Q:** Why is it important to maintain a sharp ax? **A:** Safety (prevent glancing blows) and efficiency **Q:** What are the two basic swings? **A:** Overhead and over-the-shoulder **Q:** Why is mastering both chopping methods important? **A:** For cutting on uneven terrain, limbing, and bucking logs that are not on a level plane **DISPLAY NEXT SLIDE**
Slide 30: Summary 	## Summary Review the completed objectives on the slide. **DISPLAY NEXT SLIDE**
Slide 31: Questions 	## Questions **Ask:** Are there any questions about ax basics, maintenance, and use?

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