USDA Forest Service National Sawyer Training: Developing Thinking Sawyers

Student Guide: Prework

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Module 4: Ax Basics, Maintenance and Use

Introduction

This module is an introduction to selecting and properly using an ax. The instructor 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.

Prework Topics

- Ax history
- Choosing an ax
- How an ax works
- Chopping plan

Objectives

When you complete the full module during training, you will be able to:

- Describe how an ax works.
- Identify the parts of an ax.
- Describe the importance of the 45-degree angle.
- Select appropriate personal protective equipment (PPE) when using an ax.
- Describe a chopping plan.
- Demonstrate proper chopping techniques.
- Describe how to maintain an ax.

Ax History

During the 19th century, America's agrarian society was not as mobile as our society is today. People lived their lives in small geographic areas. The individual skills of local blacksmiths and their view of what an ax needed were important factors in the development of ax-head patterns. Ax-head patterns became a matter of regional preference. This resulted in hundreds of ax-head patterns over the last 150 years.

Around the turn of the 19th century, ax manufacturers produced more than 300 different ax-head patterns in the United States; many of these were nearly identical. To simplify identification and eliminate unnecessary or duplicate patterns, the Ax Manufacturers' Association agreed to set a standard, which resulted in a standard chart of ax patterns.

For basic wood operations, there are three types of axes: double-bit axes, single-bit axes, and boys’ axes (figure 4.0.1).

Although some sawyers still carry a double-bit ax, they also need to carry a single-bit ax for driving wedges. Therefore, the double-bit ax is not the most common or practical tool to accompany a crosscut saw.

The benefit of the double-bit ax is that it has two differently tuned chopping edges. One edge of the bit is typically razor sharp and thinner and chops through green, knot-free wood. The other edge is thicker, yet still sharp, and chops through knots, near the ground, and through dead hardwood that has the potential to roll the thinner side.

Historically, the double-bit ax was designed and used as a tool for logging—where felling and limbing were the primary purpose. The longer handle facilitated chopping from a springboard, and two bits was advantageous for limbing while walking down a large log.

Modern Axes

Today, the primary task of an ax is bucking. For this task the single-bit ax is considered superior. Not only can you use the poll for driving wedges, but the shape of a single-bit ax allows a more balanced transfer of energy from head to bevel; a single-bit ax therefore cuts more aggressively than a double-bit ax. This is the reason competition choppers exclusively use single-bit axes even in the absence of wedging.

The boy's ax is a smaller version of the full-sized, single-bit ax. The smaller dimensions and lighter weight of this ax make it desirable for less demanding tasks such as pruning trees, splitting kindling, and log carpentry. It is called a **boy's** ax because these tasks were typically assigned to boys, while grown men handled the more physically demanding jobs that required a full-sized ax.

Ax Types

Figure 4.0.1—Ax types.

- Double-bit ax
  - 3 to 4 pounds
  - Cannot pound wedges
  - Typically has a 36-inch handle
  - Not safe when swung and left in a tree
- Single-bit ax
  - 3 to 6 pounds
  - Chops well and pounds wedges
  - Handle length varies from 26 to 36 inches
- Boy's ax
  - 2 to 3 pounds
  - Good for limbing and pounding wedges
  - Typically has a 28-inch handle

Ax Anatomy

The double-bit ax became popular in the mid-1800s. Figure 4.0.2 shows the parts of an ax.

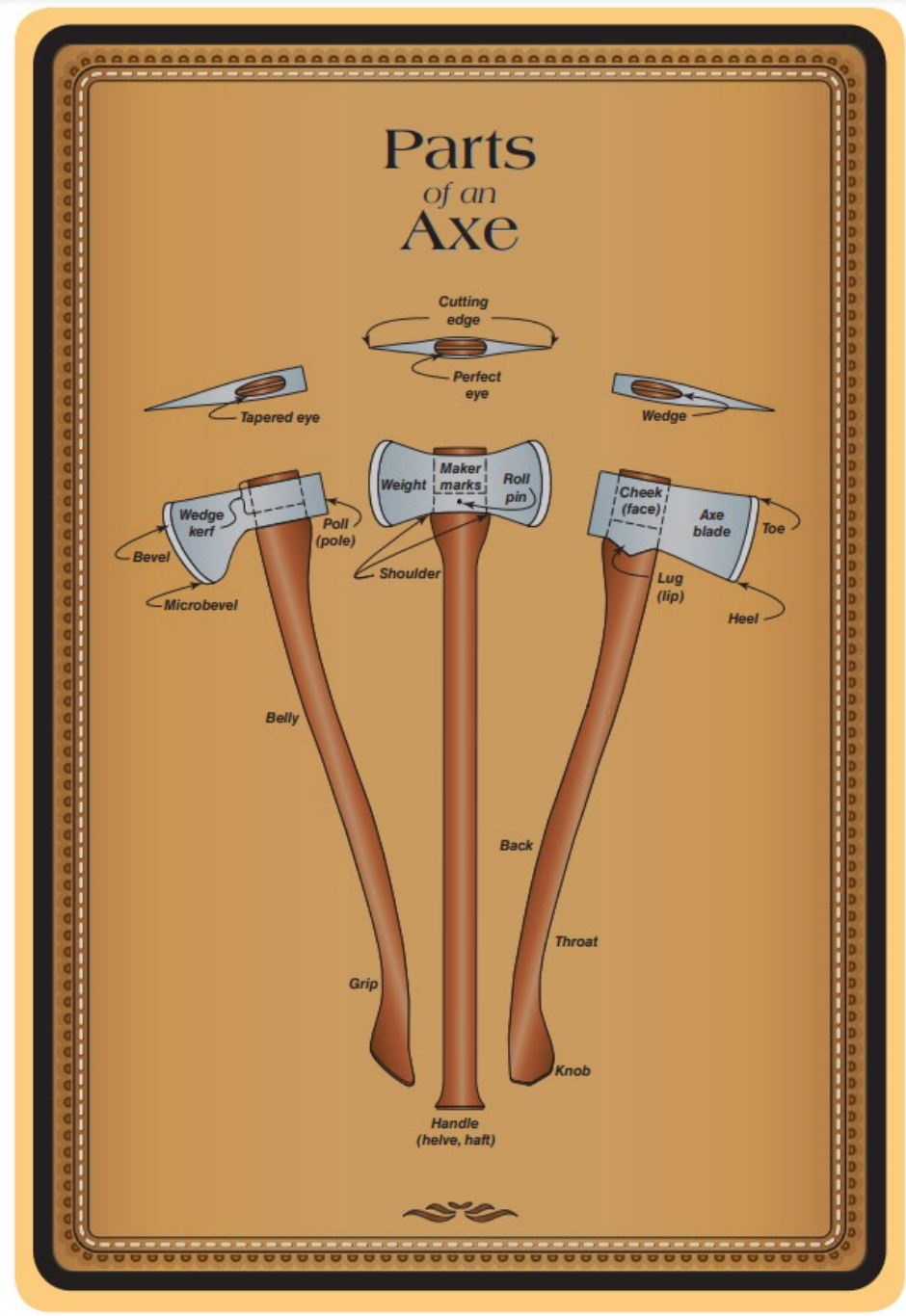

Figure 4.0.2—Ax anatomy.

Choosing an Ax

Matching the weight of the head and the length of the handle to the specific ax user is paramount to the functionality of the ax. The head weight must be heavy enough to carry sufficient energy into the wood to sever and split the log, and the handle size must be the appropriate length for the user to drive the cutting edge powerfully and accurately into the wood fiber (figure 4.0.3).

Sizing

Newer and smaller ax users will find that a 3½-pound head is a good starting point. As you become more proficient in swinging the tool, you may want to move to a heavier head. Competition choppers typically use a 5½- to 7-pound head. For day-in-and-day-out woods work, an ax this heavy is unwieldly and too heavy. A 4- to 4½-pound ax head is a great size for chopping undercuts, bucking logs, limbing, and wedging.

Person's height	Appropriate handle length
5 foot, 5 inches	27 inches
5 foot, 7 inches	29 inches
5 foot, 9 inches	30 inches
5 foot, 11 inches	31 inches
6-foot, 1 inch	32 inches
6 foot, 8 inches	36 inches

Figure 4.0.3—Check for appropriate handle length

The shape and thickness of the ax handle is also important. A thinner, elliptical-shaped handle affords the ax user better control. Manufacturers make most stock handles too thick, and it is recommended that the user plane or rasp the handle material down to fit the user's hand size. A properly thinned ax handle will allow the ax user's thumb to overlap the end of the user's index finger (figure 4.0.4).

Figure 4.0.4—An ax handle with a proper fit for the user.

Handle Purchasing

The wood grain of many mass-produced ax handles often runs at an angle or even perpendicular to the cutting edge of the ax head (figure 4.0.5). The grain should run parallel to the ax head for added strength and durability. A handle with wood grain that runs perpendicular to the direction of the ax head is more likely to break. When selecting a handle, ensure that the grain runs parallel to the ax head and inspect the grain throughout the length of the handle.

Figure 4.0.5—Wood grain examples.

Depending on how the manufacturer cut the handle, it may contain sections where the grain does not run the full length of the handle. This is known as **runout** grain. Areas where the grain runs short have an increased chance of splitting or separating. Runout on the belly or back of a handle is a clear indication that the grain of the handle is wrong.

When purchasing handles in a hardware store, it is important to look at all handles for knots, kinks, bows, bends, grain runout, and misoriented grain. Often, it is not possible to find a handle that is acceptable for professional use in a hardware store. When using an online dealer, it is often possible to spend $2 or $3 extra per handle to request "straight grain, hand-selected, non-lacquered handles." This small amount of extra money upfront will save you from purchasing one dozen ax handles that are destined to be hickory or ash fire pokers before long.

How an Ax Works

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.

Ax Profile

Having a sharp ax is very important for functionality. Equally, if not more important to chopping, is the ax shape. When you swing an ax, the sharpness of the bit severs wood fibers, and the shape of the cheeks pop out the chips. A sharp ax with cheeks that are too thick will not penetrate into the log and pop out chips, whereas a sharp ax with cheeks that are too thin will slice into a log and get stuck because the cheeks are too thin to pop out chips.

Figure 4.0.6 shows three axes, which are all sharp, but only one is shaped correctly.

The ax on the left has too thin of a profile. This ax will sever fibers, but chips will not pop out. Swinging this ax is like swinging a 4-pound fillet knife. Although this ax will enter the log and cut fibers, it will get stuck in the log.

The ax in the middle is not functional and is dangerous because it has too thick of a profile. This ax is very likely to bounce off of the log. When this happens, the ax user may lose grip of the tool and send the ax through the air, thus creating a very dangerous situation.

The ax on the right has a correct profile. This ax will sever fibers and split the log along its grain, chips will pop out, and it will not get stuck in the log.

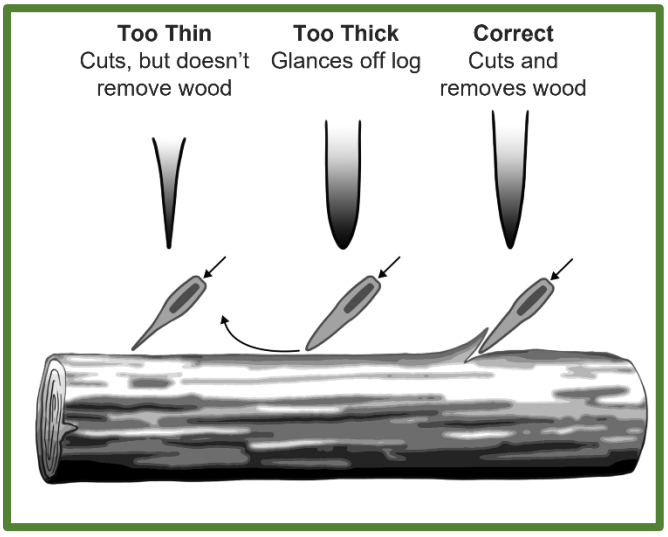

Figure 4.0.6—Ax profiles.

Chopping Plan

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, or the mental portion of the task of chopping.

Swing, shape, and sharpness: **the three Ss of ax work**

Safety and efficiency go hand-in-hand with ax work.

Swing: The first thing to master is your swing. Placing blows in the correct place and correct angle is the most important aspect of ax work.

Shape: The shape of the ax in relation to the cheeks comes in second. A properly profiled ax (figure 4.0.7) will penetrate wood and remove chips.

Sharpness: The third, most important, "S" of ax work is the sharpness**.** A sharp ax is very important to ax work, but the ax will not function if the ax user does not swing and shape the ax properly.

Figure 4.0.7—A cheek gauge showing a correctly profiled ax.

Removing Wood by Volume

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. If you construct a free face, the log will split to that free face and a chip will pop out.

Wood Fibers and Lignin

A piece of wood is really a bundle of individual cellulose fibers held together by lignin, which acts as a glue. Think of the wood fibers as a series of individual straws held tightly together.

In hardwood species, the fibers are densely packed. In softwood species, the fibers are less densely packed. The lignin that holds the fibers together is less dense than the fibers and creates an avenue for splits in the wood to propagate.

The 45-Degree Angle

The bit of the ax slices through wood fibers, and correctly shaped cheeks split the wood along the grain allowing chips to pop out from the log. Proper delivery of the bit into the wood makes an ax a very efficient tool. Figure 4.0.8 below shows how 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 that 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.

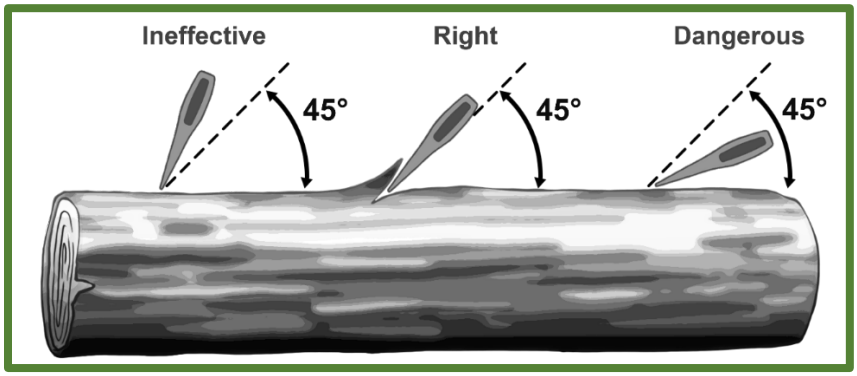

Figure 4.0.8—Importance of the 45-degree angle.

Summary

In this prework packet you learned about ax basics, maintenance, and use. This knowledge will aid in learning the material presented in Module 4: Ax Basics, Maintenance, and Use of the "Developing Thinking Sawyers" course.

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