

TECHNICAL REPORT

LIMB: A MINI-BORER FOR SAMPLING SMALL-DIAMETER TREES

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ABSTRACT

The dimensions, manufacture and application of a mini-borer to take 3-mm cores are described. This new instrument seems particularly well-suited to determining ages of saplings in situations where collection of cross-sections and coring with standard increment borers are too destructive, and where node-counting may not be sufficiently accurate. The design has resulted in trouble-free use in the field, and the mini-cores can be stored in the straws, and mounted and sanded in the core mounts used for collections of the standard 4–5-mm increment cores.

Keywords: tree cores, saplings, tree rings, borer.

INTRODUCTION

Four common methods are used to determine the age of saplings: height and diameter relationship, node count, and ring counts on cross-sections harvested from saplings and on increment cores. The first two techniques provide only an approximation of age whereas the third, though precise, results in the sapling's complete destruction. Destructive sampling is unacceptable when removal adversely affects a population of trees (*e.g.* bristlecone pines, *Pinus longaeva*, Bailey (1970), or other tree species protected by law). Increment

cores taken with standard increment borers (shoulder width of about 11 mm or greater) impact 1/3 or more of a 3-cm diameter sapling and can lead to vertical stem splitting. The ability to core at or near the root collar is also more difficult with a standard borer.

Less destructive tools for sampling saplings have been developed for age determination of small-diameter trees. In the early 1980s, a micro-borer was developed by Sharik *et al.* (1983) to sample oak seedlings and saplings in the Appalachian region of the U.S. This micro-borer is limited to a 30-mm boring length and has a difficult core extraction method. The Trephor Tool (Anfodillo 2004) was designed to sample a stem's out-

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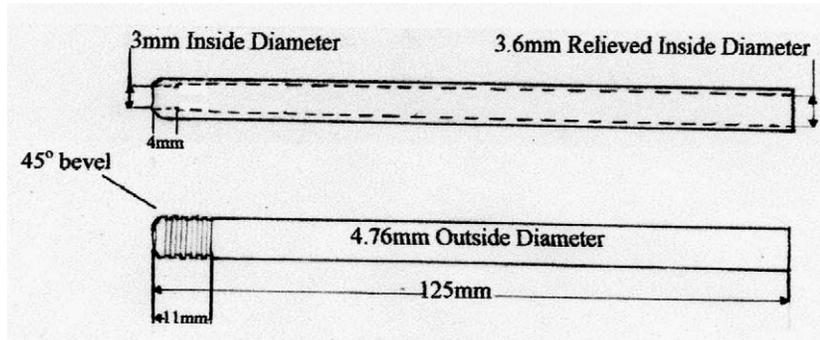


Figure 1. Schematic of LIMB dimensions.

ermost tissues only. The forceful insertion of the Trepbor Tool (via a hammer) made it unsuitable for sampling small-diameter trees. These shortcomings necessitated the development of a new borer for sampling small-diameter bristlecone (*Pinus longaeva*) and limber pines *Pinus flexilis*) described here.

MATERIALS AND METHODS

The LIMB (LIttle Mini-Borer) was built from a 125-mm-long stainless steel tube with an outside diameter of 4.76 mm and an inside diameter of 3 mm (Figure 1). An 11-mm-long thread was cut into the forward tip of the tube using a #12 × 32 threads per inch die to help propel the bit through wood. A relief (widening) was drilled from the back of the bit to 4 mm from the tip making extraction of the core easier. The leading edge of the tool was tapered to a 45° angle and sharpened to allow clean cutting of the core.

A variable-speed, reversible cordless drill was used to drive the LIMB into saplings with diameters ranging from 14 to 75 mm (Figure 2A–D). Usually a low speed was used to engage the borer, and then it was operated at a higher speed. By placing the drill on its side on the ground, cores were taken 1 cm above the root collar. A “through-tree” core (from one side through the center to the opposite side) was then taken so that any rings that were transected by the core were visible. A small wooden block was placed at the estimated exit area to ensure the opposite side’s bark was captured by the borer. The bit was removed from the stem by putting the drill in reverse

and backing it out. After the sample was taken, the bit was removed from the drill. From the tip end, a hardwood dowel was pushed through the beveled end of the borer and the sample was removed.

A few prototype borers were tested with varying lengths of thread and depths of relief until the best dimensions were determined. The failed borer designs all resulted in jamming the borer. After the current tool dimensions were established, no problems were experienced in the field with the borer. Using the paper straws for protecting core samples taken with standard increment borers, a minor issue occurred because the straw was so much larger than the core. To solve this problem, the sides of the straws were pinched tightly around the mini-core to prevent movement of the sample inside the straw. Only two cores were twisted and a few were broken, but overall we were very pleased with how well the tool preformed.

PRACTICAL APPLICATION

Thirty-three saplings were sampled from Patriarch Grove, Blanco Mountain, Golden Siren, and the bristlecone pine dendrograph study site done by Harold C. Fritts (Fritts 1969) in the White Mountains, California. Of the 33 saplings, 29 were bristlecone pines and 4 were limber pines. The saplings varied in diameter from 14 to 75 mm. Most of the mini-cores were taken approximately 1 cm above the ground to capture the maximum number of rings. The specimens were mounted in readily available standard 4.3-mm core mounts whose tops were slightly sanded down (Figure 2E). Because the difference between a 4.3 mm and

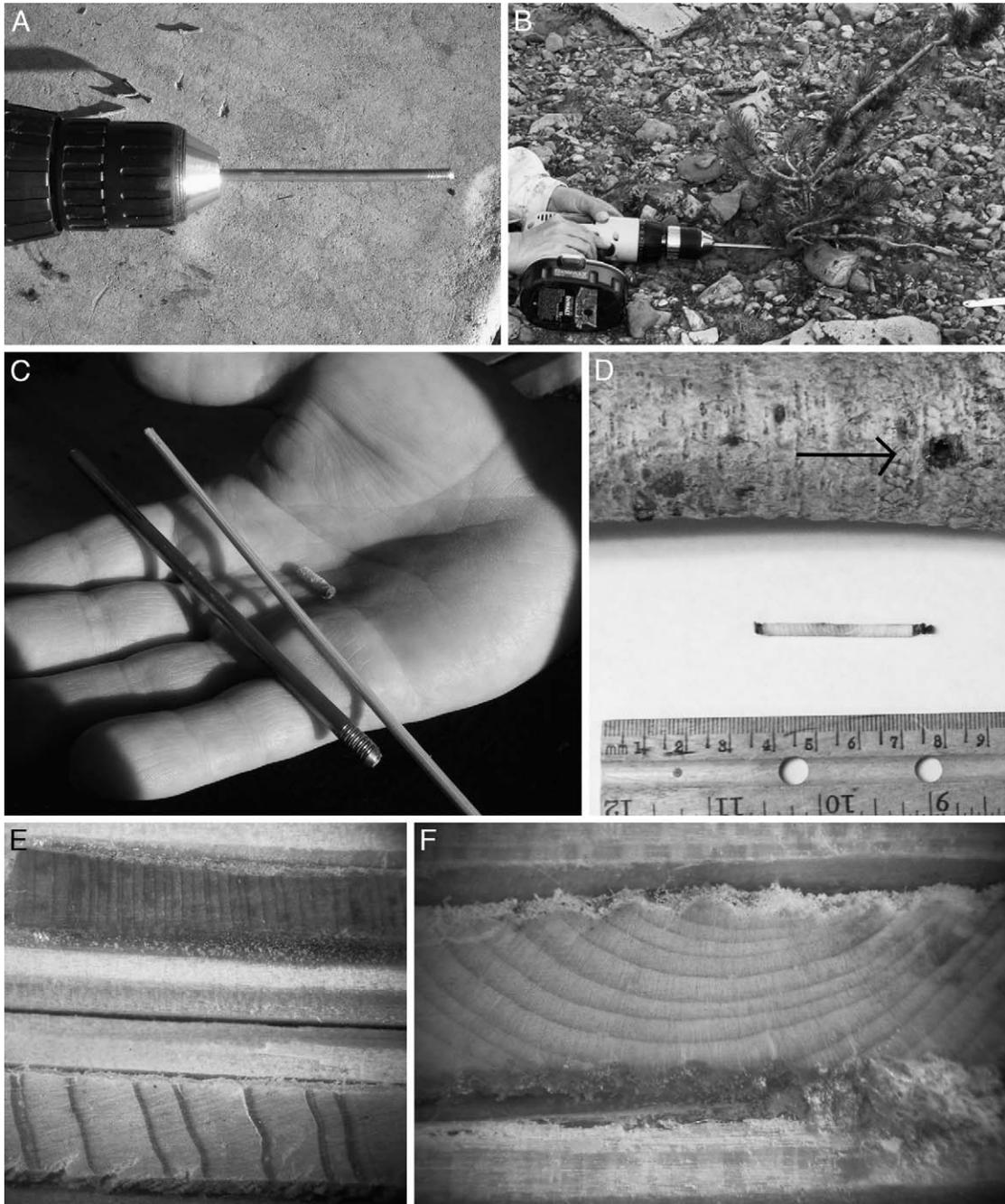


Figure 2. A. LIMB with drill. B. LIMB inserted into sapling. C. LIMB, wooden dowel, and core, left to right respectively. D. Hole left behind after sample taken. E. Mini-core (bristlecone pine) above 4.3 mm core (Douglas fir). F. Mini-core with rings.

our 3 mm core is only 1.3 mm, a smaller mount was not necessary. The shoulders of a 4.3 mm core mount were sanded prior to mounting the mini-core so that the sample sat higher above the mount and was easier to sand. Annual rings were counted after preparation (Figure 2F). Even with the smaller diameter core, rings were identified with the same ease as a standard 4.3 mm core.

In future studies, cores taken by the LIMB could also be dated using standard crossdating techniques that apply to a standard increment core or a cross-section. Using a cross-section does allow the researcher to view more wood surface, but the primary purpose of this paper is to introduce the LIMB as a tool to reduce potentially destructive impacts from standard borers and sapling cross-sections and for obtaining better age estimates via ring counts vs. node counts. Preliminary results from our investigation indicate that in some instances node and ring counts are the same, although in one sapling 49 rings were observed but only 8 nodes counted. A more comprehensive comparison between node counts and ring counts

is the subject of a future paper. This mini-borer would be useful in studies where the researcher was concerned about sapling or sample destruction (e.g. forest regeneration, recent treeline migration, protected trees, etc.).

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