Tree Coring

Introduction

Tree coring is used to determine the age of trees and reveal information about structural health, growth rate, growth patterns, and previous wounding or disease. Annual growth rings visible on a core sample can be counted to determine tree age. The relative spacing of the rings indicates growth rate and growth patterns.

A dendrochronologist is required to analyze tree cores in detail. The analysis can reveal historic information about climate change. For example, rings are spaced farther apart when sunlight and water are abundant, when physical wounding occurs (such as fire damage), and when competition changes occur (such as the death of an overstory tree, which allows more sunlight to penetrate).

Some consider tree coring to be potentially harmful to trees. The coring technique used to take a sample wounds the tree and may introduce pathogens or open up existing pockets of infection within the wood tissue that had been successfully compartmentalized by the tree. Use of tree coring assumes that the tree is healthy enough to seal off pathogens both chemically and physically before the organisms have a chance to spread and possibly cause systemic infection.

Applying Tree Coring to Cultural Landscape Research

Tree coring is a valuable investigative technique in cultural landscape research when a mature tree appears to date from a known period of significance, but historic documentation about the tree is lacking. For example, in cultural landscapes where the period of significance is recent, questionable trees may have a caliper size of only six inches.

In addition, different growing conditions affect the size of trees from an assumed average, making age estimation difficult without coring. The decision to core must consider physiological and morphological characteristics of a particular species, health status, potential vulnerability, such as genetic susceptibility or local presence of pathogens, management objectives, and the proposed treatment for the landscape.

Tree coring was used as a research tool at Weir Farm National Historic Site in Connecticut to develop a restoration treatment plan for the site. Historical research had not revealed whether particular trees dated from the period of significance. The trees were cored and the data helped planners decide whether to keep or remove the trees in question.

Performing the Technique

Equipment

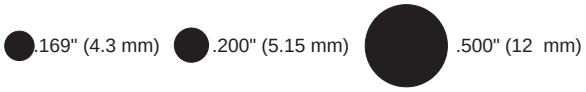
When coring a tree, it is best to use the smallest diameter bit possible for the increment borer. (See Figure 1.) Borer bits range in diameter from 0.169 inches (4.3 mm) to 0.5 inches (12 mm). A bit diameter of 0.169 inches is adequate for determining age, but larger sizes are more typically used for quantitative analysis in silviculture research. The bit length used depends on the radius of the tree with some extra length to ensure the borer reaches the center of the trunk. Bit lengths range from approximately 6 to 30 inches. The increment borer bit should be sharp (a 3-thread bit penetrates more easily than a 2-thread bit) and sterilized with rubbing alcohol.

Selecting an Increment Borer

Three things to consider when ordering an increment borer are length, diameter, and style.

Borer bit length depends on the size of the trees you will be boring. Length is measured from the tip of the threads to the end of the round section of the borer bit. This is the maximum depth the bit will penetrate.

Core Diameter for the wood sample is determined by the inside diameter of the opening at the threaded end of the bit. .169 inches is commonly used for general forestry use, .200 inches for wood preserving testing, and .500 inches for large amounts of wood for quantitative analysis.



2- or 3-Thread Style is a matter of personal preference. A 2-thread borer has two threads on the cutting edge of the bit, each originating 180° apart. A 3-thread borer has three threads, each originating 120° apart. The 3-thread borer, due to its higher pitch, will penetrate the wood deeper per revolution than a 2-thread and also produce less friction because more threads are pushing against the wood. It is important to remember that the ease at which a borer penetrates wood depends on wood hardness, friction properties, and capability/strength of the user.

Figure 1. Photograph of an increment borer and extractor and a diagram indicating how to select an appropriate increment borer size. (Photograph courtesy of Forestry Suppliers, Inc., 1996)

Figure 2. An increment borer is used to core a Douglas Fir (Pseudotsuga menziesii) tree. San Juan Island National Historical Park. (NPS, 1987)

Sterilization should be repeated between successive cores to prevent disease transmission between trees. After sterilization, the increment borer is lubricated with a natural wax, such as beeswax. If beeswax is coated along the borer to the same length as the radius of the tree, the end point of the wax can be used as a gauge of when the centerpoint of the trunk is reached.

Drilling the Core

The best position for drilling is the one that allows for the operator's optimum leverage and control. Tree coring is a strenuous activity, so the preferred working position for the operator is at stomach or chest height.

Coring involves removing a core sample from the trunk of a living tree using the increment borer. (See Figure 2.) The core is a segment of the cylindrical trunk, corresponding in length to the trunk radius (the core extends from the outer bark to the center of the trunk). To obtain the core that is best for aging the tree, drilling should occur at the lowest point on the trunk before the transition to the root zone (just above the root flair). This location contains the greatest number of rings because it is the oldest part of the tree. The higher up the tree trunk, the fewer the number of growth rings. If the core is taken too low in the root flair, the core will be difficult to read. In this transition zone, stem cells are modified as root cells and the signature of rings becomes diffused. Approximately three to four feet above ground level is ideal.

Once the drilling location is determined, the increment borer is positioned so it can reach the center of the trunk. After drilling, just beyond the center (or up to the end of the beeswax), the drill is reversed through one revolution to loosen the core. An extractor is then inserted to remove the core. The borer should be backed-out immediately so that proximate tissues will not swell. If swelling occurs, removing the borer will be difficult, if not impossible. The drill hole in the tree trunk should be left untreated.

If the tree radius is larger than the bit length of the increment borer, the center of the trunk cannot be reached in a single core. The age of the tree then must be interpolated. Age interpolation is done by determining what percentage of the

radius the borer can penetrate, calculating the number of rings per inch in the extracted core, then interpolating how many rings the remaining uncored tissue will bear. The same interpolation must be applied when a tree trunk is hollow and a complete core cannot be extracted. It may be very difficult or impossible to remove the increment borer from a hollow tree trunk.

Determining Age

A core should extend a little beyond the center of the trunk to ensure that the centerpoint can be visually identified. Wetting the core with water or applying core dye may make the rings more legible. Consecutive growth rings at the center of the trunk (at the end of the core) appear as increasingly acute single "parentheses," which become inverted beyond the centerpoint. The midway point between the only "paired parentheses" marks the centerpoint; this is the reference point to either begin or end counting. Each growth ring represents one year of life.

Some species are easier to read than others, due to ring size, porosity of cells, presence of tannin, or chemical discoloration. In the more difficult cases it may be necessary to use staining treatments or dyes, magnifying lenses, and microscopes to visually enhance the rings for counting. These procedures may demand the expertise of a dendrochronologist.

References

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