NAME _____ DATE _____ CLASS _____

INQUIRY LAB – BACKGROUND

How Nature Records Changes in Climate

Concepts

- Climate change
- Dendrochronology
- Annual rings

Background

Trees contain some of nature's most accurate records of the past. Each spring and summer, a tree adds new layers of wood to its trunk. The wood formed in spring, known as springwood, grows fast and is lighter in color because it consists of large cells. In summer, growth is slower. Summerwood has smaller cells and is darker in color. These layers of alternating lighter springwood and darker summerwood are called annual rings. The number of annual rings can be counted to find the age of a tree. It is possible in some years that more than one ring is made. These false rings occur due to disease, frost damage, or injury. Under these conditions, ring counts are not always 100% accurate.

The individual layers of growth in the cross-section of a tree begins at the center and continues outward to the area of most recent growth. The newest growth layer is surrounded and protected by a layer of bark.

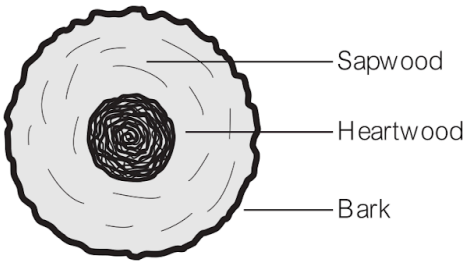
Tree growth in a specific year depends on a complex set of local growing conditions. The amount of rainfall and water availability is one key variable affecting the growth rate in a given year. Since most trees grow more during wet, cool years than during hot, dry years, tree rings are usually wider during wet years. Drought or a severe winter can cause narrower growth rings. When rings are consistently the same size, it suggests that the climate is consistent from year to year.

In temperate regions, seasonal growth in the diameter of a tree usually continues longer in conifer or softwood trees than in deciduous or hardwood tree. Softwood trees continue to produce growth late into the fall. The growth rings in softwood trees are therefore larger than those in hardwood trees. Some hardwood trees, such as ash, oak, elm, hickory and black locust, have distinct rings. Other hardwoods, such as birch,

maple, poplar, and sycamore, produce cells (vessels) of similar size through the growth rings, which makes it more difficult to identify the springwood from the summerwood.

Many hardwood trees may also exhibit two distinct regions of growth (see Figure 1). The outer area of the new growth is usually light in color and represents an area of active or live tissue. This region is known as sapwood. A darker region, known as heartwood, may also be present. The heartwood is dead and often filled with gums and resins that give it a darker color.

Figure 1



Scientists can use tree-ring growth pattern data to identify trends and construct models of past weather and climate conditions. The field of study that looks at historical patterns in plant growth and climate is known as dendrochronology. Modern dendrochronologists do not usually cut down trees to analyze their annual rings. Instead, a boring device known as an increment borer is used to extract a small core sample from the tree. The boring device is screwed into the center of the tree trunk and a straw-size sample—about 4 mm in diameter—is removed, and the hole in the tree is then sealed to prevent disease. The tree rounds used in this activity were obtained from limbs of trees that had already been cut for some purpose. Scrap limbs are usually burned for waste, so these tree rounds are, in effect, being recycled.

With the aid of computers, dendrochronologists can analyze regional tree growth data to generate models of past climate changes either in specific regions or worldwide.