Section I
NATURAL HISTORY OF THE COAST REDWOODS

Chapter 1 of this section introduces the three species of "redwood," and discusses what is so special about the coast redwood, *Sequoia sempervirens*. Chapter 2 provides a review of basic scientific and ecological principles, especially as they pertain to the coast redwood ecosystem. Chapter 3 reviews some of the major environmental concerns about the coast redwood ecosystem. Chapter 4 provides information about some of the most common or most important organisms found in the coast redwood forest.

This is not intended to be a comprehensive or detailed summary of the science associated with studies of an individual species such as the coast redwood, nor of a complex ecosystem such as the redwood forest. It does provide basic background for teachers and others who may not have extensive backgrounds in forestry or forest ecology. Elementary students need not learn all of this information. However, teachers who have a good background in the natural history of the redwoods will be better able to take advantage of "teachable moments" while with students in redwood parks and forests.

The study of science enables students to understand how the world works, to appreciate nature's beauty, wonder, and importance, and to fund one's place in the world. While the learning of vocabulary is not an end in itself, a working knowledge of scientific terms makes learning and communicating easier. Likewise, discovering the etymology of words facilitates the understanding of both scientific and non-scientific terms. Throughout *Redwood Ed*, **bold** type emphasizes important vocabulary that will help clarify the information being reviewed. (See Appendix II for a glossary of terms.)

Chapter 1
The Redwoods

There are three species of trees that are commonly referred to as "redwoods." All three species have until recently been classified in the family Taxodiaceae, which includes other trees such as the "bald cypress" of the southeastern U.S., a type of Japanese cedar, and a Chinese tree mistakenly called a "fir." They are now classified in the cypress family, Cuppressaceae. Some other trees are sometimes called redwood, including Montezuma bald cypress, *Taxodium mucronatum*, which is the national tree of Mexico. Other related species of "redwood" occur in various parts of Asia. There are even three species of "Tasmanian redwood," *Athrotaxis* spp. (Helfer, 1966). (See Chapter 4 for a discussion of naming and classification of organisms.)

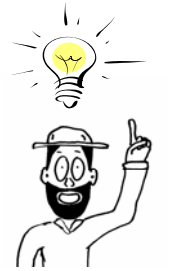
Each of the three species of trees that will be referred to as redwood in *Redwood Ed* is classified in its own genus, and they are the sole living representatives of those genera. The three types of "redwoods" are:

- The coast redwood: *Sequoia sempervirens*
- The giant Sequoia, big tree, or Sierra redwood: *Sequoiadendron giganteum*
- The dawn redwood: *Metasequoia glyptostroboides*

Cuppressaceae is an ancient family of trees, dating back to the middle of the Triassic period (about 240 million years ago). Redwoods thrived during the days of the dinosaurs. In these ancient times, various related genera and species were spread throughout Europe, North America and Asia, even extending into Australia. As climates changed and glaciers came and went, various species became extinct, leaving only the three relict species living in divergent and very limited areas.

An example of these ancient redwoods can be seen at the Petrified Forest in Calistoga, northeast of Santa Rosa. Here students can see petrified redwood trees that were apparently knocked over by a volcanic explosion. As the wood decayed, it was replaced by minerals, resulting in "petrified wood."

Teaching Idea



Group tours are available at The Petrified Forest. See the web site at:

< www.petrifiedforest.org >

See figure 1 on page 9.

Figure 1. The first entry of an automobile into the "petrified forest," September 10, 1911. (Photo courtesy of The Petrified Forest)

The Dawn Redwood

The dawn redwood, *Metasequoia*, once lived throughout the high northern latitudes. It was thought to be extinct until 1944, when a Chinese botanist found some living specimens in central China, where it was called the water-larch or water-pine and was fed to cattle. In 1946 it was "officially" classified. A tree thought to have been extinct for 20 million years was found to be thriving! By 1948 the attractive tree was being planted in many places throughout the world. It is a good thing that the seeds were spread and planted, because by 1980, no dawn redwood seedlings or young trees could be found in the valley where they were rediscovered, apparently because of human population growth in the area (Barbour *et al.,* 2001).

The dawn redwood, unlike the coast redwood or the giant Sequoia, is **deciduous**, losing its leaves (needles) in the winter. Its leaves and cones resemble those of the coast redwood very closely; in fact, *Metasequoia* fossils were often mistakenly identified as *Sequoia*.

Teaching Idea

The Save-the-Redwoods League has produced a booklet about the dawn redwood. Redwoods of the Past, by Ralph Chaney (1990), includes pictures of fossils, a map showing the distribution of the dawn redwood and coast redwood, and a variety of pictures of Metasequoia. See Appendix III for the League's contact information. An accounting of the dawn redwood's discovery can also be found in Barbour et al. Coast Redwood (2001).

The Giant Sequoia

The giant Sequoia redwood was once common in northern North America, but climate changes reduced its range until only one species, *Sequoiadendron giganteum*, remains. These magnificent trees are confined to about 75 scattered groves on the western side of the Sierra Nevada, from the south fork of the American River to the southern Sierra.

The giant Sequoias are the most massive things to have ever lived on Earth.***** While they don't match the coast redwood in height, their girth can be massive. The "General Sherman Tree," in Sequoia National Park, is 275 feet tall, 27 feet in diameter, and over 80 feet in circumference. Its lowest branch is about 150 feet above ground, 6 feet in diameter at its base, and 150 feet long. Giant Sequoias can live to be over 3,500 years old, making them among the oldest living things. Giant Sequoias were extensively logged during the gold rush even though they tended to shatter upon hitting the ground. Most are now protected in state and federal parks, although some are still commercially harvested.

*****What constitutes a single "living thing" isn't as simple as one might think. Mushrooms have root-like structures called mycelia which can cover many acres and sprout many mushrooms above ground. If all of those mycelium-connected mushrooms are considered to be one organism, such an organism may be the largest living thing. Similarly, several coast redwoods may sprout from the root system of a fallen tree. If all of those sprouts from the common root system are considered to be a single organism, their mass may exceed that of the largest giant Sequoia.

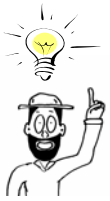
Teaching idea

Many parks and schools have planted dawn redwoods and giant Sequoias. If you are visiting a park, find out whether they have specimens to which you can compare the coast redwood.

The Coast Redwood

The coast redwood, *Sequoia sempervirens*, is the subject of this guide. As a species, it appeared in western North America at least 23 million years ago, but other species of redwood-like trees were here long before that. Some authors date *S. sempervirens* to around 60 million years ago (Noss, 2000). Eight to ten thousand years ago, *Sequoia sempervirens* ranged farther south, but since the climate has become drier and warmer, its range has moved farther north while the southern part of its range has constricted.

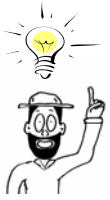
Teaching Idea



All three types of redwoods can be purchased from nurseries and will grow throughout the coast redwood region and beyond. Work with local nurseries, parent-teacher groups, timber companies, and environmental groups such as those listed in Appendix III to obtain young trees of all three types and, with students, plant them on the school grounds. This might be done on Arbor Day or Earth Day in conjunction with a ceremony honoring an individual, a group or company, or even the trees themselves for their contributions to our society. Consider some sort of time capsule or plaque.

Prior to planting, be sure that there is adequate space for a tree that will someday be quite large, that there is adequate water, etc. Check with your buildings and grounds staff.

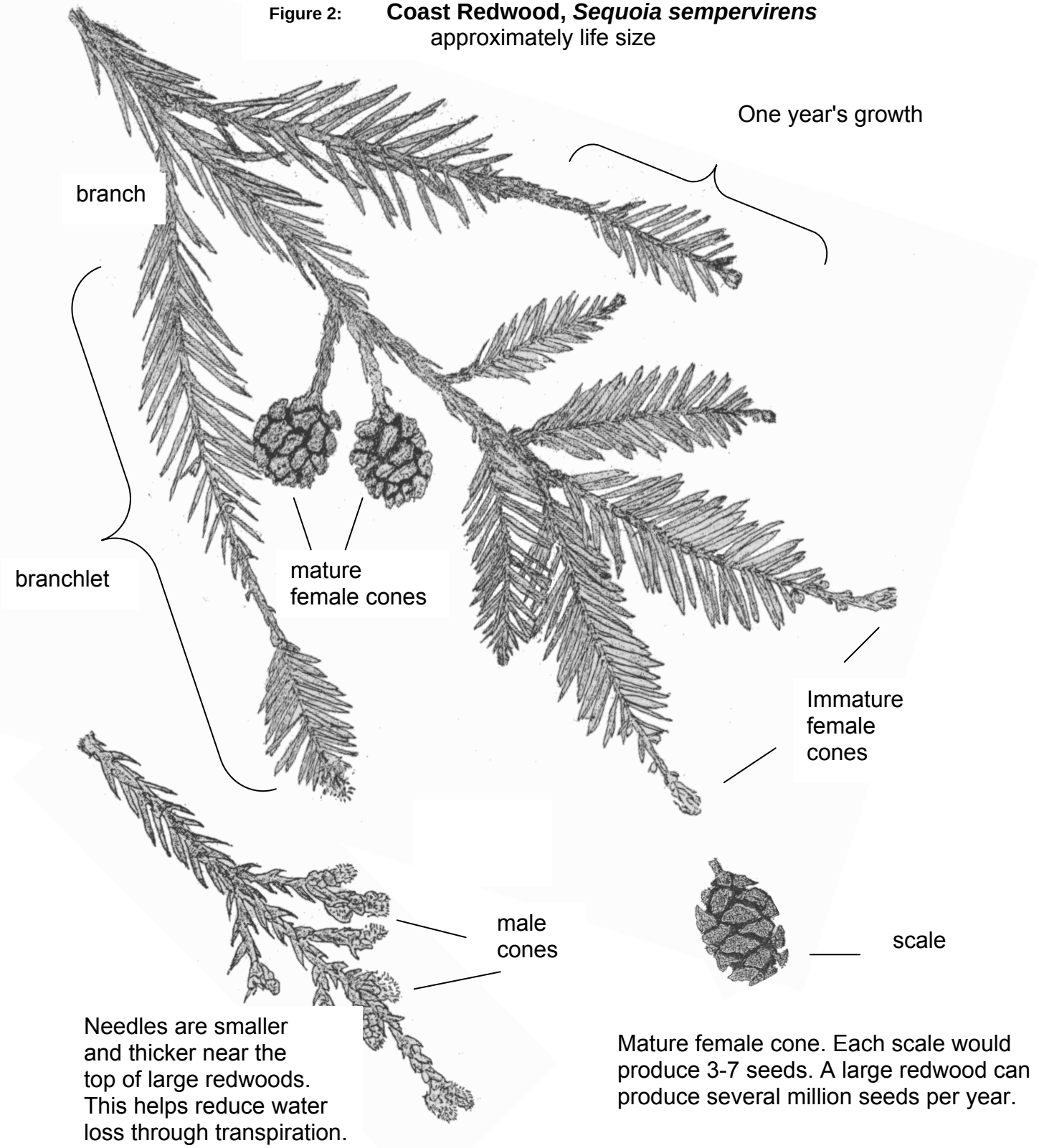
Teaching Idea



If you plant trees, start collecting baseline data…height, diameter at base, diameter breast height, diameter of the area beneath the branches. Take photographs with a student holding a yard stick for comparison. Record this information and update it annually. Compare the three species for such things as growth rate, diameter of the area beneath the branches, insects found on or around the trees, or other things that students notice and can record for comparison over the years. If you do this, plant them in similar sunlight and soil conditions and arrange to have them watered similarly.

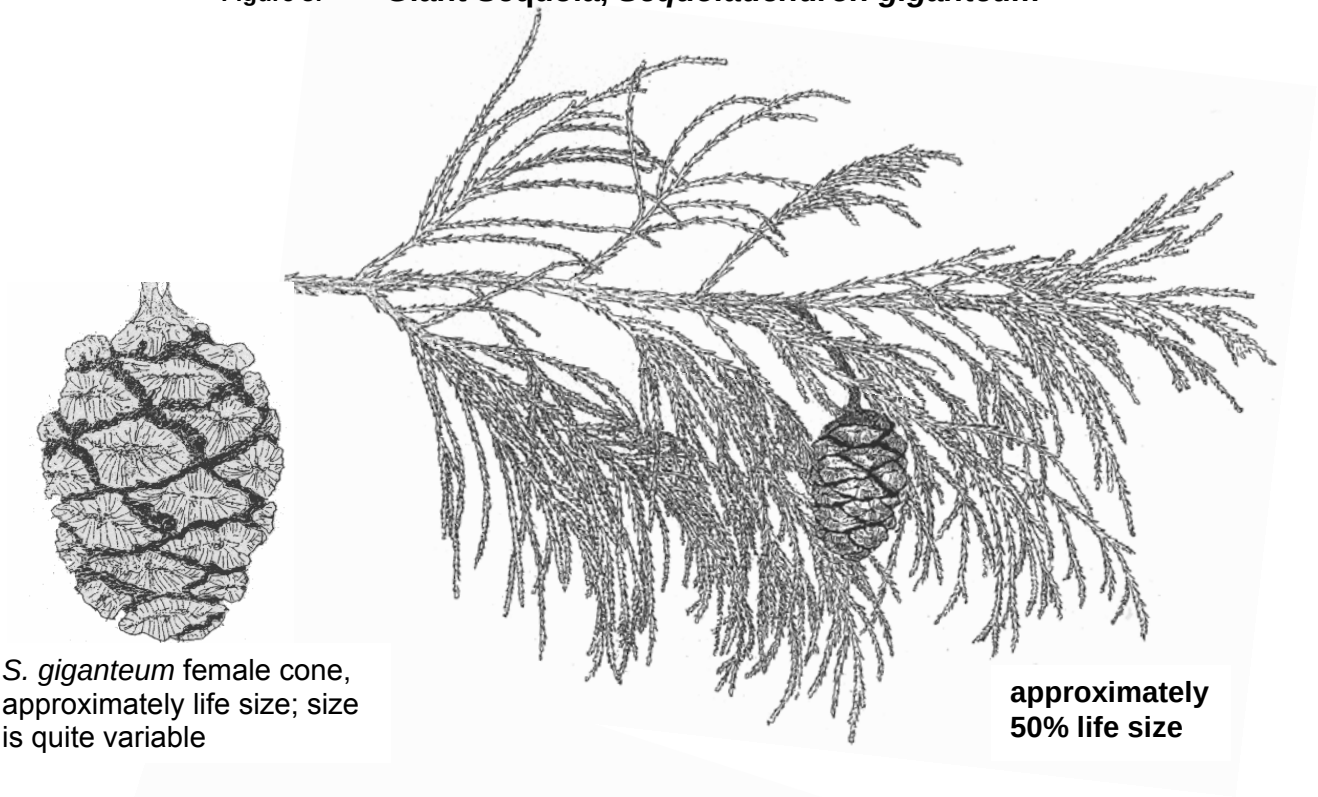
Another possible study can be done on trees of the same species growing under different conditions. Trees can be planted in full sun, partial shade, and full shade, or can have different watering schedules. Compare growth rates, needle size, density of branches and twigs, or other characteristics.

Figure 2: **Coast Redwood, *Sequoia sempervirens***
approximately life size



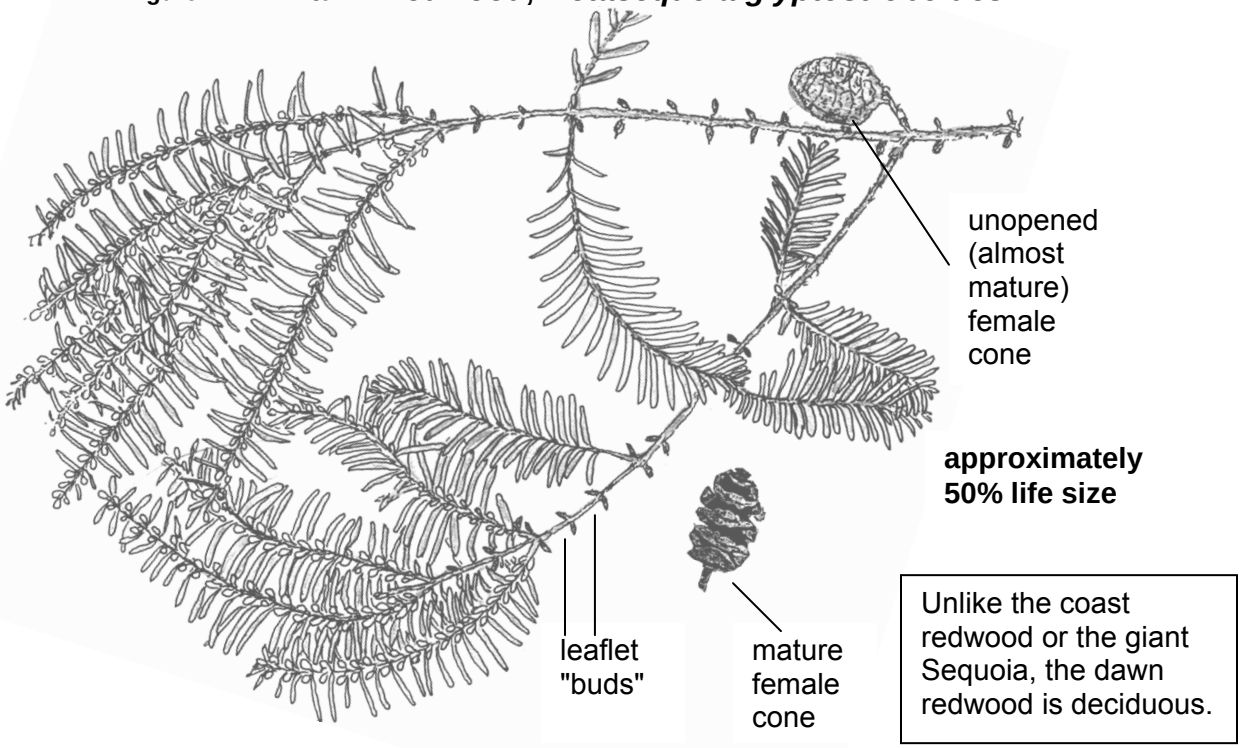
Drawings from *Life History and Ecological Guide to the Coast Redwood, Sequoia sempervirens*, by Daniel J. Miller.

Figure 3: **Giant Sequoia, *Sequoiadendron giganteum***



S. giganteum female cone, approximately life size; size is quite variable

Figure 4. **Dawn Redwood, *Metasequoia glyptostroboides***



Drawings by Daniel J. Miller. S. giganteum cone from *Life History and Ecological Guide to the Coast Redwood, Sequoia sempervirens*, by Daniel J. Miller.