Introduction

Giant sequoia is one of the most well known species in the world. It is an iconic species known for its overwhelming size and assumed long-lived nature. Because of their massive size, however, accurate age estimates are elusive. Understanding the ages of these beautiful trees can be a very important piece of information to have when considering various areas of research and management.

This project had three primary objectives:

1. Gather general age information for all of the study trees. This was done to determine general differences, if any, in age within or between the various groves used in the study. Using a previously developed equation unique to giant sequoia developed by Stephenson and Demetry (1995), age estimates were made to help understand the release potential of old trees.
2. See if any methodology improvements could be made. These included measurements of wet and dry lengths of cores to improve accuracy. We specifically examine the potential for improvement to the “shrinkage-coefficient,” which is related to the shrinkage of cores that occurs following collection.
3. We addressed the question: Do older trees actually look older? This was a subjective effort done as possible, when not possible diameter at core depth was used.

Methods

Study Area:

Our study areas were located on Giant Sequoia National Monument, managed by the US Forest Service. They were determined by harvest activities occurring in the 1980’s that created structures with low canopy densities dominated by large, old giant sequoia. The structures were created by shelterwood regeneration harvesting, which removed all trees other than the large giant sequoia and sometimes pine species, thus creating a “high severity mechanical disturbance.” Once these areas were located, corresponding control areas that had not been harvested were located as well. In total 9 study areas were identified in 7 different sequoia groves. These groves being Redwood Mountain, Breakin, Little Boulder, Lockwood, Black Mt, Long Meadow, and Starvation.

Treatment and Study Design:

- Selection of trees was based on acquiring a sample of large trees from across the harvested areas.
- One to two 24 inch core increments were taken from each tree.
- Trees were taken at close to 4.5 ft above ground as possible, when not possible diameter at core height was taken.
- Once the core was removed its full length (i.e. wet length) was measured immediately.
- Three random bark probes were taken to obtain an average measure of bark thickness, which was later subtracted from the core diameter.
- In the lab the dry length of each core was measured. This dry length was then compared to the previously measured wet length to find the “shrinkage coefficient.”

Equation 1: Age estimation equation developed by Stephenson and Demetry (1995)

\[ d = 0.230 + 0.759 \left( \frac{100}{g \, \text{mm}} \right) + 1.27 \, r \]

C = full ring count of a partial increment core
\( g \) = length of the innermost 100 rings of the increment core
\( r \) = total length plus the length of the section of the core radius not sampled
A indicates the direction and one of ring width change with time

- Using the field and lab measurements, the age of each tree was estimated using an age estimation equation unique to giant sequoia developed by Stephenson and Demetry (1995).

Results

Age Estimates:

The mean age found was 1009 years, the maximum 2438 and the minimum 271 years. The age histogram (Figure 2) did not show a distinct age distribution pattern, however, in conjunction with the age distribution by grove (Figure 3) it shows the variability of age present within and between groves. Figure 3 also shows the possibility for small age ranges within a grove, specifically Redwood Mt., Starvation and Black Mt.

Shrinkage Coefficient Results:

We found that the average shrinkage coefficient was 1.04. As seen by Figure 4 the majority of values fell between 1.0 and 1.1. These calculations included 3 outliers with values less than 1.0. These values are likely due to measurement error and the true mean value without outliers was 1.05. This compares to the value of 1.02 used as a constant by Stephenson, 2000.

Discussion

Age Estimates: While our estimates are nowhere near exact we were able to find valuable age data that has never existed before for multiple groves. These ages were found as a component of a larger research project looking at the release potential of old giant sequoia post high disturbance activity. Studies of this nature have been done in the past, but never with age estimations in conjunction. These ages will be able a valuable component of this research project (York et al. 2010 and York unpublished data). We did not find a distinct age distribution between groves, but instead found great variability within and between groves. In some instances we found groves with small age ranges, which may be a predictor of regeneration post high severity disturbance.

Shrinkage Coefficient: In attempting to improve the current aging methodology we examined the possibility of improvements to the shrinkage coefficient. This figure is necessary as counting the inner 100 rings and measuring them in the field while still wet is impractical. We found that while the coefficient tended towards 1.04-1.05 they had the ability to be highly variable. Not only can they be variable, but our average ratio is much larger than the 1.02 figure used by Stephenson and Demetry (1995). 1.02 is a reasonable figure, but shows the importance of obtaining core-specific measurements when possible. When core-specific measurements are not taken there is a chance to over or underestimate the age of trees.

Do They Look Older? Few people have spent large amounts of time examining both the ages and physical appearance of these large trees. While the synthesis of information in this area is highly subjective it may have implications for future discussions of the definition of “old growth.” Due to the highly variable physical characteristics of trees in relation to age common ideas of an “old growth” tree being defined by a certain age could be questioned.

Conclusions

Age estimates from this research project will provide a much larger sample of known sequoia age. This will be a valuable component of future research on the release potential of old giant sequoia post high disturbance activity. The synthesis of information in this area is highly subjective it may have implications for future discussions of the definition of “old growth.” Due to the highly variable physical characteristics of trees in relation to age common ideas of an “old growth” tree being defined by a certain age could be questioned.

References and Acknowledgments


Special thanks to the SPUR Program for funding and to Ricky, Kate, and Kenton for field work help!