The Role of Fire in Giant Sequoia Ecology

Fire has been an important ecological factor in giant sequoia ecosystems over the millennium. In order to perpetuate these magnificent trees, our management programs must recognize the role fire has played in the past and simulate that role as closely as possible in the future. Without periodic burning, giant sequoia seedlings would not become established and the groves themselves would be threatened by catastrophic fire. Numerous studies have given us the information necessary to accomplish this. For instance, in groves where it is impractical to allow naturally-ignited fires to occur, i.e. the Mountain Home Grove, prescribed burns can be planned and scheduled to mimic natural fires. Fire scars from the Mariposa Grove in Yosemite show an average return interval of 11 years while data from Mountain Home Demonstration State Forest indicate fires as frequent as every 2.5 years. Prescribed burns should follow the distribution of those frequencies so that they would represent a natural pattern of burning. In addition, fire scar and tree data provide information on the season of burning, therefore, burning schedules could replicate those times. Both charcoal deposits and fires scars show episodes of fire incidence corresponding to extensive dry periods. The data show that during those periods, fires occurred over large areas. Managers should consider increasing the size and number of prescribed burns during similar dry seasons.

Fire plays a number of roles in the successful development of giant sequoia. Fire is the primary mechanism for removing forest litter that accumulates on the forest floor. Though this may seem elementary, it is essential for natural reproduction of giant sequoia. Sequoia seed is very small and upon germination the radicle (leading primary root) must enter into soil rather than duff. If the seed does not come in contact with bare mineral soil, the radicle soon dies.

Giant sequoia is a species that is considered to be intolerant, which means that it cannot grow in the shade. Canopy openings are required for successful regeneration of shade intolerant species to provide gaps that allow sunlight to reach the forest floor. Increased sunlight benefits ponderosa and sugar pine as well.

In a good year, under favorable conditions, sequoia produce numerous cones. Mature sequoias may have upwards of 2,000 cones on a single tree. The cone is produced in the first year but does not mature until the following year. Giant sequoias can retain their cone for 25 to 30 years with the seed remaining viable. Why would a tree adapt to retain cones for such a long period of time? It is because the cones are serotinous. Which means that the cones will remain closed until sufficient heat is introduced into the canopy. When enough heat reaches the cones, they will open and release their seed. The key to successfully regenerating giant sequoia “naturally” is through fire. Studies show that low intensity burns have little if any effect on releasing seed. One could argue that the tree itself has adapted to higher intensity levels of burns to secure
it's own existence. If the burn is not hot enough to remove the duff layer thus exposing bare mineral soil, why would the tree release it’s seed for guaranteed failure of germination?

Can managers therefore create conditions conducive to natural regeneration of sequoia? I would suggest that the answer is yes. Albeit, the stand would not necessarily be regenerated “naturally” as the climatic conditions would be selected and sub-canopy treatments would be prescribed. Such investigative work is currently being studied following a commercial timber harvest at Mountain Home.