Restoring Native California Oaks on Grazed Rangelands

Douglas D. McCreary
Jerry Tecklin

Douglas D. McCreary is Program Manager, Integrated Hardwood Range Management Program, Department of Environmental Science, Policy and Management, UC Berkeley, 8279 Scott Forbes Road, Browns Valley, CA 95918; telephone: 530.639.8808; e-mail: ddmccreary@ucdavis.edu. Jerry Tecklin is Staff Research Associate, retired, 8279 Scott Forbes Road, Browns Valley, CA 95918; e-mail: jetecklin@ucdavis.edu

In: Dumroese, R. K.; Riley, L. E.; Landis, T. D., tech. coords. 2005. National proceedings: Forest and Conservation Nursery Associations—2004; 2004 July 12–15; Charleston, NC; and 2004 July 26–29; Medford, OR. Proc. RMRS-P-35. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Abstract: Efforts to regenerate oaks on California's oak woodlands often must address how to establish seedlings in areas grazed by livestock. Research indicates that damage to young oak seedlings from cattle varies by season, with less damage during the winter when deciduous oaks do not have leaves. While exclusion of cattle from planted areas does result in reduced damage, the buildup of thatch or dead grass following livestock removal can promote an increase in damage to seedlings from voles (*Microtus californicus*) and grasshoppers (*Melanoplus devastator*). The most effective method we have found to simultaneously grow oaks and cattle incorporates individual tree protectors called "treeshelters." Limited research suggests that treeshelters protect seedlings from damage from most animals, including livestock. Cattle will browse the shoots of seedlings growing up and out the tops of 1.3-m (4-ft) shelters, but that damage is rarely lethal and has relatively little long-term impact to oak seedling establishment. Unprotected oak saplings appear relatively resistant to cattle damage if they are at least 2 m (6.5 ft) tall. Together, these findings suggest that cattle and oaks can be raised simultaneously if sufficient protective measures are taken to prevent damage to young plants.

Keywords: *Quercus*, treeshelters, livestock, regeneration, woodlands

Introduction

California's oak woodlands, also known as hardwood rangelands, cover approximately 3 million ha (7.4 ac), or 10% of the State. These areas have an overstory of trees, predominantly in the oak genus (*Quercus* spp.), and an understory of exotic annual grasses and forbs, with occasional native perennial grasses. Oak woodlands provide a wide range of critical values and services including forage for livestock, important wildlife habitat, recreation, beautiful scenery, and watershed protection. Since European settlement, these lands have been managed primarily for livestock production (Figure 1).

For nearly a century, there has been concern that several of California's 20 native oak species are not regenerating adequately (Jepson 1910). Such concern was partially responsible for the establishment of the Integrated Hardwood Range Management Program (IHRMP) in 1986, a cooperative effort between the University of California, the California Department of Forestry and Fire Protection, and the California Department of Fish and Game to promote oak woodland conservation (Standiford and Bartolome 1997). Evidence indicating that there is an "oak regeneration problem" in California has been based largely on observations of a paucity of young seedlings and saplings in the understories of existing oak stands. Describing the foothill woodland in the Carmel Valley, White (1966) stated that "A prevailing characteristic . . . is the lack of reproduction . . . with very few seedlings." Bartolome and others (1987) also concluded that "current establishment appears insufficient to maintain current stand structure for some sites." And Swiecki and Bernhardt (1998) reported that of 15 blue oak locations evaluated throughout the State, 13 were losing stand density at the stand level due to unreplaced mortality.

The species that are having the most difficulty regenerating are all members of the white oak sub-genera of *Quercus*, and include blue oak (*Quercus douglasii*), valley oak (*Q. lobata*), and Engelmann oak (*Q. engelmannii*) (Muick and Bartolome 1987; Bolsinger 1988). Blue and valley oak are endemic to the State, while Engelmann oak, which actually has a far narrower distribution range than the other 2 species, does extend into Baja California (Griffin and Critchfield 1972). Concern about poor

Figure 1—The vast majority of oak woodlands in California are privately owned, and the primary economic activity on these lands is livestock grazing.

regeneration has been responsible for the initiation of a wide range of research during the last 2 decades aimed at both understanding the major factors contributing to regeneration failures, and developing strategies to overcome obstacles to successful regeneration. Research has addressed a wide array of subjects, including acorn collection, storage and handling, seedling propagation methods, and techniques for planting, protecting, and maintaining seedlings in the field (McCreary 2001).

Grazing Experiments

The University of California Sierra Foothill Research and Extension Center (SFREC) is a 2,300-ha (5,700-ac) field station in the low-elevation foothills of Yuba County, CA, that supports a large research cattle herd. It also provides land and facilities for a variety of natural resource-related research. Part of this research has been aimed at developing practical, low-cost procedures for restoring oaks. Several of these oak-regeneration studies have been conducted in areas grazed by cattle, with one of the objectives being to identify how oaks can be established in grazed pastures without removing these lands from livestock production. That is, how can cattle and oaks be raised together? This is important because approximately 80% of the oak woodlands in California are privately owned, and the primary use of these properties is livestock production (Bolsinger 1988).

Timing of Grazing Study

In 1989, a UC Davis graduate student named Lillian Hall initiated an experiment at the SFREC to evaluate how planted oak seedlings fare in pastures where cattle have access (Hall and others 1992). She planted 1-year-old blue oak seedlings in pastures grazed by cattle at different stock intensities, and included a control where cattle were excluded. She found that damage to seedlings was significantly less in the winter and fall when the deciduous oaks did not have foliage and were apparently less appetizing to the cattle. Cattle did not seem to seek out or prefer young oaks. However, in the spring green-forage season, they appeared drawn to clover patches near seedlings and browsed the oaks in the process. Heavy damage to seedlings in the summer at all cattle densities probably resulted from the fact that the young oaks were often the only green vegetation in the grazed pastures, and were therefore more palatable than the dry annual grasses. Within each season, total damage also increased with increasing stock density.

Riparian Restoration Planting

In 1994, we initiated a study at the SFREC to evaluate alternative practices for restoring woody plants along a perennial stream that had been cleared of woody vegetation in the late 1960s. As a result of this clearing, there were few trees or shrubs adjacent to the stream, and the predominant vegetation included broadleaved cattail (*Typha latifolia*), rushes (*Juncus* spp.), and sedges (*Carex* spp.). This study evaluated 3 different methods for restoring woody plants along a 600-m (1,970-ft) section of the stream. Treatments including fencing (cattle only excluded, deer still had access), protection of individual plants with treeshelters, and a control consisting of planting, but no protection. Treeshelters are rigid, translucent double-walled plastic tubes that are placed over individual seedlings, protecting them from a variety of animals, including both deer and cattle. They also stimulate accelerated shoot growth of the seedlings growing inside the tubes (McCreary and Tecklin 2001). However, in grazed pastures, it is critical that shelters be secured with heavy metal fence posts so that they are not bent over or broken as a result of cattle rubbing on them.

Each of the protection treatments was replicated 5 times in 30-m (100-ft) stretches of the stream, and in each replication we planted 70 total seedlings and cuttings, including Fremont cottonwood (*Populus fremontii*), Arroyo willow (*Salix lasiolepis*), narrow-leaved willow (*S. exigua*), blue oak, valley oak, and interior live oak (*Q. wislizenii*). During each year of the study, cattle grazed the area where the plantings were located. Generally 30 to 60 head were placed in the 30-ha (74-ac) pasture for a 3- to 6-week period. All plantings were evaluated for 4 years, and each plant was assessed annually for survival and year-end height.

Results of this study (McCreary 1999) indicated that successful restoration of the oaks required protecting individual seedlings with treeshelters. After 4 years, average survival in treeshelters for all oak species combined was 58%, while oaks in fenced plots had only 5% survival, and unprotected seedlings in control plots had less than 1% survival. Oak seedlings that did survive in treeshelters grew quite vigorously, with an average height of nearly 2 m (6.5 ft) after 4 years.

Ungrazed and Grazed Plots

In 1997, a 2-ha (5-ac) oak planting that had been initially established at the SFREC in 1990 (Tecklin and others 1997) was divided in half, with one-half of the plot exposed to

limited grazing for approximately 5 weeks per year. The blue oak seedlings in the plot varied greatly in size because they had been established in different years, and some had been protected with treeshelters and others had not. As a result, plants varied from a few cm tall—usually resprouts after seedlings had been girdled at the ground—to healthy, robust saplings that had grown above the tops of the 1.3-m (4-ft) treeshelters (Figure 2). After 3 years, plants inside grazed plots were compared to those outside (Tecklin and others 2002). There was no increase in mortality resulting from the grazing, but there were differences in seedling condition between grazed and ungrazed plots. Unprotected seedlings in ungrazed plots had significantly more vole damage than unprotected seedlings in grazed plots (52% versus 0%). This was due to the fact that, in ungrazed plots, there was a large increase in dead thatch on the surface of the ground. Such thatch is ideal habitat for voles and resulted in higher population levels and much more bark stripping and girdling of oak seedlings. For the oaks protected with treeshelters, however, the results were almost the opposite. That is, there was evidence of far greater animal damage in the grazed plots—the animals in this case being cattle—while there was virtually no animal damage to the oaks inside treeshelters in the ungrazed plots. Damage in the grazed plot consisted of clipping of the shoots that were above the tops of the 1.3-m (4-ft) shelters, resulting in noticeably sparser crowns. Some of the shelters were also partially bent over from cattle rubbing (though all were secured with heavy metal fence posts), but no seedlings were killed. There were differences in height and basal diameter growth between sheltered plants in grazed and ungrazed plots, with those in grazed plots growing less. However these differences were relatively small and seedlings that were browsed were not seriously damaged.

Figure 2—Treeshelters are double-walled plastic tubes that have been successfully used to protect outplanted oak seedlings from a variety of animals including cattle.

Study to Evaluate Cattle Impacts to Various-Sized Oaks

Another study to evaluate the impacts from cattle to a range of sizes of oaks was commenced in 2003. This study used a blue oak planting that was established at the SFREC between 1988 and 1990 by Ted Adams (Adams 1995), a Wildland Specialist at UC Davis. He had established several hundred oaks inside a 0.22-ha (0.5-ac) plot, fenced to exclude both deer and cattle. At the initiation of our study, there were a total of 144 living seedlings and saplings that ranged in height from 43 cm to 4.3 m (17 in to 14 ft). We divided this plot in half and opened half of it to cattle grazing. This plot was within a 40-ha (100-ac) pasture that was grazed for 6 weeks in 2003 by 50 cows and 49 calves. Prior to removing the fence for half of the plot, we assessed each seedling in both plots for height, basal diameter, and crown spread.

After a full season of grazing, we assessed each oak for the same variables we recorded before the grazing began. During this second assessment, we also noted obvious cattle damage, as well as mortality if it had occurred. Seedlings and saplings that remained inside the fenced portion of the plot grew significantly taller than those exposed to cattle (22 cm versus 8 cm [9 in versus 3 in]). Although only 1 seedling was killed in the grazed portion of the plot, the cattle did severely impact a number of the plants by browsing and rubbing. However, damage from cattle varied greatly depending on seedling initial size. Oaks less than 2 m (6.5 ft) tall were far more likely to suffer damage than plants taller than this. Of the 79 surviving oaks in the grazed portion of the plot, 11 lost more than 15 cm (6 in) in height. These were all less than 2 m (6.5 ft) tall at the start of the study. Furthermore, the average height gain during the 2003 growing season of the 46 plants greater than 2 m (6.5 ft) at the start of the study was 30 cm (12 in). In contrast, the 33 plants less than 2 m (6.5 ft) at the commencement of grazing lost an average of 22 cm (8.6 in) in height. Although this study has only been in place for a single year, and we plan to maintain it for at least 2 more years; initial results indicate that there is a threshold height above which oaks are large enough to withstand cattle damage. It appears that this threshold is near 2 m (6.5 ft) (Figure 3).

Summary

Native California oaks can be established in pastures grazed by cattle, but it is important to protect individual seedlings from browsing and rubbing until they are approximately 2 m (6.5 ft) tall. Excellent protection can be achieved by placing individual 1.3-m (4-ft) tall treeshelters around young seedlings. These devices not only protect seedlings from a variety of potentially damaging animals, including cattle, but also stimulate rapid aboveground growth. However, where livestock are present, it is critical that shelters be well secured to heavy metal fence posts to ensure they remain upright and are not bent over from cattle rubbing. Seedlings growing up and out of the tops of 1.3-m (4-ft) shelters are vulnerable to livestock clipping of the exposed shoots; in moderately grazed pastures, such damage appears to have little long-term impact on seedling survival or growth.

Figure 3—Oak seedlings that are at least 2 m (6.5 ft) tall appear to be large enough to withstand injury from cattle.

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