THE IMPACT OF MANAGEMENT OF GIANT SEQUOIA STANDS ON BREEDING BIRD POPULATIONS

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Abstract: A minimum treatment consisting of cutting, piling, and burning small white fir and incense-cedar from 1 to 11 feet in height was carried out in the spring of 1966 on two 20-acre plots in a cutover giant sequoia forest. Some broadcast burning was also employed. During the first two years following this initial manipulation, (1) numbers of white fir and incense-cedar decreased substantially on the treated plots while holding steady or increasing on the control plots; (2) numbers of nesting wood pewees and robins increased; (3) four species of birds requiring brush, chaparral, or dense shady vegetation in their habitat decreased in numbers or disappeared; (4) the remaining 24 species showed no obvious shift in numbers found nesting in the area.

The role of fire in altering the environment and setting back plant succession has been noted by ecologists for many years. But detailed studies of the impact of fire on various vegetation types and on animal life are just beginning. The first annual "Fire Ecology Conference" was held in Florida in 1962 (Komarek, 1962). With the advent of this yearly conference, scientists and resource managers have had a specific yearly opportunity to discuss the practical and theoretical importance of fire in many habitats. To date little has been done on the impact of fire on bird and animal life.

My own work concerns the role which fire plays in modifying succession in coniferous forests--particularly the "fire climax" giant sequoia (Sequoiadendron giganteum) forest segment of the Yellow Pine Forest Formation (Munz, 1959). Specifically, I am concerned about the impact of these vegetative changes on breeding bird populations.

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The broad significance of work in this area arises from a growing concern on the part of both scientists and land management agencies about the build-up of highly flammable dead and living fuels in the Transition Zone coniferous forests and specifically in giant sequoia stands. The unnatural aspects of this condition, many believe, have come about and are continuing today because of our efficient fire suppression programs combined with logging activities and other types of forest disturbance over the past half-century or more.

Studies by Reynolds (1959), Biswell (1961), and Hartesveldt (1964) indicate that both lightning fires and fires set by aborigines in many of these forested regions tended to keep fuel levels much lower than those found today. Recent measurements in this forest type (Biswell, Gibbens, and Buchanan, 1968) have shown that dead fuel accumulations may amount to from 9 to 25 tons per acre between ground level and 11 feet, not including live fuels and litter and duff which may add many tons more.

These conditions seem to be fairly widespread in the Transition Zone ponderosa pine (Pinus ponderosa)--white fir (Abies concolor) forests on the west slope of the Sierra. As such, land management agencies are seeking ways in which to reduce fire hazards and to restore the original nature of plant and related animal life in these areas. This applies particularly to our national parks and to zones surrounding the giant sequoias. One of the most natural means of reducing fire hazard in these areas would be the use of prescribed burning.

With this background, a project was initiated in 1964 to investigate means of reducing the hazards of all-consuming crown fires in the giant sequoia forest type (Larson, 1966). Among the other goals of this research project were (1) creation of conditions favorable to wildlife; (2) creation of conditions favoring plant successions which will lead to restoration of a more primitive-like forest; and (3) development of a management system by which open, park-like conditions can be maintained on a continuing basis.

The study area selected was Whitaker's Forest, a 320-acre experimental forest located on the west slope of Redwood Mountain in Tulare County, California. This forest--at approximately 5,500 feet elevation--is owned by the University of California, and is bounded on the north, east, and south by Kings Canyon National Park, and on the north, west, and south by Sequoia National Forest.

The primary tree species of this forest are the giant sequoia, white fir, incense-cedar (Libocedrus decurrens), sugar pine (Pinus Lambertiana), ponderosa pine, and California black oak (Quercus Kelloggii). The forest was logged in the 1870's and nearly half of the mature sequoias were cut

down at that time, along with a sizeable share of both species of pine (Buchanan, Biswell, and Gibbens, 1966); additional logging in the 1940's further reduced the numbers of mature pine and took some large white fir and incense-cedar. Some 230 mature sequoias more than 8 feet in diameter remain on Whitaker's Forest (Biswell, Buchanan, and Gibbens, 1966).

The height of the present forest canopy varies from the 15-foot dogwood (Cornus Nuttallii) to giant sequoias of 250 feet or more (Ibid). The mature sequoias and many of the young ones which came in soon after the logging tower over most of the associated species, although some white fir, incense-cedar, and pine reach a height of more than 150 feet.

The tree density on study plots at Whitaker's Forest in 1964 ranged from 4434 to 6762 individuals of all species and age classes per acre. White fir is the most numerous species and forms dense understory whenever moist, steep slopes provide ideal habitat (Buchanan, Biswell, and Gibbens, Op. Cit, p. 45). Both white fir and incense-cedar, however, grow in fairly dense thickets in many parts of the forest displacing physically and replacing to some extent ecologically the shrub layer which is often found in successional stages of this forest type.

While shrubs and herbaceous vegetation were more numerous after the forest had been opened up by early logging (Ibid, p. 46), shrubs are now very limited in number and distribution. Herbaceous vegetation is sparse except in the few riparian woodland and meadow situations along creeks in the western half of the forest.

Sample Plots and Manipulation:

In 1964, two pairs of 20-acre plots were established -- one pair on the steeper eastern section of the forest, where giant sequoian-mixed conifer forest dominates; the other two plots were placed such that they straddled Eshom Creek and included the more nearly level creek-bottom land with its strong component of pine forest-brushland vegetation type. Studies of vegetation and bird and mammal populations were made on all four plots for one year. Then in the spring of 1966, a so-called "minimum treatment" was carried out on one of each of the two pairs of plots.

This minimum treatment consisted of cutting, piling, and burning white fir and incense-cedar between the heights of 1 and 11 feet. It included cutting most standing dead trees and piling and burning the accumulation of down trees and limbs which constituted an important segment of the fire hazard conditions. Such manipulation was, therefore, not a true broadcast burn; less than 10 percent of the ground surface of the treated plots was affected by fire. Careful records were maintained for four 1/10-acre sub-plots, and it was found that in near maximum conditions of understory and debris accumulation, an average of 22 tons of fuel were removed per acre (Biswell, Gibbens, and Buchanan, op. cit.).

Bird Population Studies:

The relationship of bird populations to this problem of fire hazard in giant sequoia forests arises from the fact that birds are an important part of the wildland scene in national parks--both ecologically and from a park visitor's standpoint. Consequently, the effect on wildlife of any proposed vegetation management technique needs to be understood before the National Park Service manipulates vegetation in this way.

For my bird population studies, I used an adaptation of the plot census method known as the Williams (1936) Spot-Mapping Method. This is a repeated census over a permanently established plot, using a series of dittoed maps on which observations are recorded. A grid system was established with a 100-foot interval and the observer walked alternate lines. Activity of both sexes was recorded, but great emphasis was placed on observations of singing males, particularly simultaneously singing males.

At the end of each day, observations were transferred to a master sheet for each species. At the end of the season, concentrated groups of observations were circled as indicating the activity area or approximate territory of a pair of birds. These numbers are then converted to numbers of territorial males per 100 acres, which allows comparison with results from other areas.

Thirty species were included as nesting pairs on one or more of the four study plots. The numbers of males of all species found as part of the breeding population in this previously cutover giant sequoia forest varied from 183 to 327 males per 100 acres.

The impact of the "minimum treatment" of the manipulated plots on populations of breeding birds was clear in the case of a few species. But in most cases careful analysis of the post-manipulation data was required to determine what influence vegetative change had on bird numbers and species. Two species seemed to show a definite increase as a result of the experimental treatment -- the western wood pewee (Contopus sordidulus) and the robin (Turdus migratorius). Four species disappeared or showed a decrease following manipulation of low vegetation; each of these required brush, chaparral, or dense or shady vegetation as part of their habitat (Grinnell and Miller, 1944). These four are the rufous-sided towhee (Pipilo erythrophthalmus), the mountain quail (Oreortyx pictus), the Nashville warbler (Bermivora ruficapilla), and the hermit thrush (Hylocichla guttata). The remaining species, including the Oregon junco (Junco oreganus), the western tanager (Piranga ludoviciana), and the black-headed grosbeak (Pheucticus melanocephalus) showed no consistent change in numbers as a result of the management program.

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