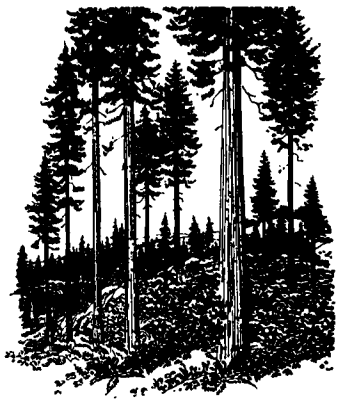
Redwood Physiology:

Key to Recreational Management in Redwood State Parks

E. C. STONE · R. B. VASEY



Soil compaction problems from increased recreational loads in the State's redwood parks are causing increasing concern for the health of these unique forest giants. New highway construction, logging activities and periodic flooding through the groves can also cause conditions detrimental to the trees. Preliminary studies reported here indicate that radical root pruning and replacement of the compacted soil may be a practical method of revitalizing redwood trees after heavy recreational use.

OVER THE LAST 1,000 years repeated flooding has deposited nearly thirty feet of silt and gravel around the base of many of the largest redwood trees. In spite of this gradual burial, the redwood tree has survived. Repeated flooding and deposition must be considered a natural part of the environment of this species.

Increased recreational loads as well as new highway construction and logging in areas adjacent to Humboldt Redwood State Park have changed the redwood environment drastically in recent years, however. Even periodic flooding over the tree roots sometimes causes conditions which are detrimental to its health. The excessively heavy December rainfall of 1955 caused extensive flooding and deposition throughout much of the alluvial flat lands of the park. The following year several groups of trees died. Others lost most of their foliage and appeared "sick."

A better understanding of the factors involved in the physiology and ecology of the redwood is considered necessary if the public is to continue to enjoy the grandeur of the redwoods on these and other alluvial flats. The University of California Wildland Research Center, with financial assistance from the State Division of Beaches and Parks, has established a Redwood Ecology Research Program. As an initial phase of the physiological studies, the impact of environmental changes on the root system and vigor of the redwood are now under study.

Pit located twenty feet from base of tree treated two years ago shows extent of re-entry of new roots into artificially created root-free two foot soil layer.

Soil compaction

There is considerable evidence that soil compaction brought on by the recreationist while he viewed the towering redwoods and enjoyed their magnificence has damaged the root system of the trees. Consequently one of the first efforts has been to determine whether the compacted soil could be broken up and the damaged root systems revitalized. A field examination of the root regeneration potential of mature trees was begun in 1959. Four trees were selected—one from each crown class (dominant, co-dominant, intermediate, and suppressed). Diameters ranged from 28 to 84 inches. Heights ranged from 150 to 300 feet.

In August, two feet of soil with the contained root mass was mechanically removed with a bulldozer over a radius of forty feet around each of the four trees.

The root collar was protected by leaving an untouched zone five feet around the base of each tree. The soil was spread back in place immediately after removal, thus creating a two-foot-deep layer of soil entirely free of live roots. The treatment destroyed 30 to 40 per cent (by volume) of the existing root system of each tree including most of the "feeder" roots.

In July, 1960, and again in October, 1961, soil samples were taken from the treated and untreated areas. Within the treated zones, samples were located at 0 to 3 and 6 to 9 inch depths along three radii running out from the center of each tree. Live root tissue was separated by hand and the volume was measured by water displacement.

Root re-entry into the "new layer" of soil was rapid. By 1960, 15 per cent of the root system had been replaced at the 0 to 3 inch depth and 23 per cent of the root system had been replaced at the 6 to 9 inch depth. By 1961, 40 per cent had been replaced at the 0 to 3 inch depth, while at the 6 to 9 inch depth, 52 per cent had been replaced. All these roots were healthy and growing vigorously. Thus, redwood trees are able to reoccupy the soil mass rapidly with new roots, despite the loss of as much as 40 per cent of their old root systems.

Among the finest of California's unique forest giants are these Coast Redwoods, Sequoia sempervirens, in the heart of Bull Creek Flat, Humboldt Redwoods State Park. Photo by Woodbridge Metcalf.

Crowns not affected

Crowns of the treated trees were examined in 1959, 1960, and 1961. No apparent change took place during the two-year period. Dieback did not occur and the crowns remained green and healthy.

Radial growth of the treated trees was also examined. Increment cores were taken from each of the treated trees and from 11 other trees in the same grove. In general the untreated and treated trees showed much the same annual radial growth changes.

Using root growth, diameter growth, and crown condition as criteria of tree health, no noticeable decline in health was apparent two years after root removal.

If these preliminary studies are substantiated by further work, this method of revitalizing redwood trees after heavy recreational use shows real promise. Such treatment is a radical departure from the old philosophy that the best management of natural vegetation is no management at all. Continuing research will be required for effective management of recreational areas.

Edward C. Stone is Associate Professor of Forestry, University of California Berkeley; and Richard B. Vasey is Laboratory Technician, U.C., Berkeley.

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MECHANICAL HARVESTING STATUS IN OLIVES

HARVESTING EXPERIMENTS conducted since 1954 to remove olives from trees by mechanical methods have shown promise in some phases but generally have been characterized by slow harvesting and a lack of economic justification. The following summary outlines the techniques used and results obtained to date:

Air blast plus catcher—low removal; theoretical studies by the University showed no promise with subsonic air flows as early as 1960. Experimental tests on prunes and olives confirmed this theory.

Mechanical combing plus catcher, 1954—to date the time to comb a tree has been excessive, about 18 man hours per ton (oil), 75 per cent removal.

Explosives plus catcher—inadequate control of air mass.

Shakers plus catchers (shaker labor only):

(1) Cable, 1954—77 per cent removal, about 10 man hours per ton (oil).

(2) U. C. Experimental, 1955—over 90 per cent removal in the northern counties. Seven to ten trees per hour. Equipment subject to fatigue failure, about 2.1 man hours per ton (canning olives).

(3) Inertia, 1960—removal could be the same as above, high energy consumption.

(4) Knocked, 1960—low removal.

(5) Trunk, experimental—low removal.

Water jet plus catcher—theoretically, the fruit can be removed with this technique. U. C. early experimental studies showed low removal. Israel reports some success with this technique.

Worker aids:

(1) Platform—lacked economic justification.

(2) Claw-type arm extension—slow.—*L. H. Lamouria, Associate Professor and Associate Agricultural Engineer, Experiment Station, University of California, Davis, and H. L. Brewer, Assistant Specialist, Department of Agricultural Engineering, U. C., Davis.*