HUMANS, BEARS AND REDWOODS:A NEED FOR APPLIED ENVIRONMENTALISM

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1988 TRANSACTIONS OF THE WESTERN SECTION OF THE WILDLIFE SOCIETY 24:135-143

Abstract: Controversy exists in Humboldt and Del Norte Counties in northern California about the strategies and techniques used to reduce black bear (*Ursus americanus*) damage to coast redwood (*Sequoia sempervirens*). In this paper we review what is known about the biology of bears living in coast redwood habitat as well as redwood forest management techniques. We propose a new strategy for dealing with bear damage problems to redwoods based on current knowledge, new research, and an awareness and appreciation for both wildlife values of bears and legitimate commercial management and use of redwood timber.

For a number of years, black bears have caused considerable damage to managed second-growth redwood forests along the northern coast of California. In 1987, the situation received a good deal of media attention. Foresters, environmental groups and policy makers have different values for both bears and redwoods. Foresters view the bears as pests, environmentalists see the bears as an integral part of the ecosystem, and policy makers are charged with protecting the value of the forests and managing a valuable game species. This paper reviews the current black bear management controversies within the redwood region. To establish a baseline for discussion, we will outline what is known about black bears in redwoods, describe redwood forest management, and review bear damage prevention techniques. Finally, we will propose a new strategy for dealing with black bear damage problems which considers all viewpoints as legitimate.

LOGGING IN THE REDWOOD REGION

Coast redwoods occur from the California-Oregon border along the coast to Monterey County (Fig. 1). Their distribution generally is limited to lower mountainous terrain (below 2,000 feet) influenced by coastal fog (Griffin and Critchfield 1972).

Much of the historical economy of northwestern California has been based on the management and harvest of this timber resource. Only recently has the overall economic base of Humboldt and Del Norte Counties begun to diversify away from timber and lumber production. In 1986 the Agricultural Commissioner of Del Norte County estimated the value of total timber harvest (coast redwood and Douglas-fir (*Pseudotsuga menziesii*) at $45,000,000.

Recently, Lloyd et al. (1986) evaluated the timber resources for the North Coast (Del Norte, Humboldt, Mendocino, and Sonoma Counties). Redwood forests occupied 26% of all timberland; 94% of this forest type was in private ownership. A total of 925,000 acres was being managed for timber production, whereas 113,000 acres was designated as federal, state or county parks. The volume of the redwood growing stock on the North Coast exceeded four billion cubic feet in 1985.

History

Redwood harvest along the North Coast began in the late 19th century. At that time, old growth timber was harvested with manually operated saws and axes; consequently, the rate of harvest was relatively slow. With the introduction of mechanized harvest tools, chain saws, and diesel tractors, harvest rates increased dramatically. As the amount of time required to log an area decreased, so did the period of time between cuttings (commonly referred to as "rotation"). Currently, most timber companies practice a rotation of between 65 to 80 years (L. Bradshaw, Simpson Timber Co., pers. comm.)

Originally, logged areas regenerated through stump-sprouting. This process often resulted in multiple sprouts from a single stump and subsequently produced stands with exceedingly high densities. Later methods used aircraft for aerial broadcast seeding. Depending on the site and survivorship of the seedlings, this technique often resulted in densities as high as 3,000 trees/ac. After a period of 5 to 10 years these areas were pre-commercially thinned to densities of approximately 600-1,000 trees/ac and managed at that density until the stand was between 25 and 30 years old. Finally, these stands were commercially thinned to densities that would be managed until the stand was harvested (300 to 450 trees/ac) (L. Bradshaw, pers. comm.). Current regeneration practices use hand planted two-year old nursery grown seedlings. This allows foresters to plant selected genotypes at densities that are suitable for a particular site. The 1973 Z'Berg-Nejedly Forest Practice Act requires that a minimum density of 300 trees per acre be planted.

Consequently, the redwood forests of northwestern California are a mosaic of different age-class stands. Because these stands are in various stages of growth, site-

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Fig. 1. Distribution of coast redwoods (*Sequoia sempervirens*) in California.

specific management practices are required rather than general plans designed to manage an entire region. Except for a few small areas of yet unharvested timberland, only the forests currently being managed as parks are in the later stages of succession ("old growth").

THE BLACK BEAR IN THE REDWOOD REGION

Though a number of authors have studied the ecology and habitat preferences for black bears in Washington, Oregon and parts of northern California (Kelleyhouse 1975, Lindsey and Meslow 1977, McCollum 1973, Piekielek and Burton 1975, Poelker and Hartwell 1973), the literature is essentially void of any references pertaining to black bear ecology in redwood forests. Only recently have biologists from Redwood National Park begun to evaluate the basic natural history characteristics for bears within the Park (T. Hoffstra, pers. comm.).

Kelleyhouse (1975) and Piekielek and Burton (1975) studied black bears in north-central California. Both studies evaluated habitat utilization, movements, and population densities of bears. McCollum (1973) studied black bears in southwestern Oregon and evaluated habitat utilization and movements. Although all three of these studies were done in close proximity to the redwood region, ecologically the areas have very little in common. All three studies were done in areas of mixed coniferous forests at elevations much higher than those found in redwood forests, with canopy and understory vegetation much different than one would find in second growth-redwoods.

Distribution

The subspecies *U. a. altifrontalis* (Hall 1981) ranges from the east slope of the Cascade Mountains throughout western Washington, south along the coast through Oregon and into northern California. Though black bears are common throughout much of northern and eastern California, another subspecies, *U. a. californiensis* inhabits this region of the state (Hall 1981).

Within redwood forests, black bears tend to occur in areas dominated by second-growth trees. In mature or old-growth stands, food and cover is probably limited throughout most of the year. Early seral stages of second-growth stands (areas that have been logged and are in the process of regeneration) are densely covered with a number of forbs, grasses and woody perennials that provide cover, denning sites and food. This understory vegetation includes salal (*Gaultheria shallon*), *Rhododendron* spp., sword fern (*Polystichum munitum*), thimbleberry (*Rubus parviflorus*), salmon berry (*R. spectabilis*), and huckleberry (*Vaccinium ovatum*). Kelleyhouse (1975) stated that "Current land-use decisions in northern California are being made without information about the importance of various habitat types to black bears." The same can be said today for the redwood region.

Population Densities

Most authors that have studied black bears in the western United States agree that bear densities are approximately 1 bear per mi^2, although Piekielek and Burton (1975) estimated seasonal densities as high as 2.0 bears per mi^2 in Trinity County, California. Kelleyhouse (1975), also working in Trinity County, estimated bear densities at 1.1 bears per mi^2. Black bear densities within the Redwood National Park do not vary significantly from 1 bear per mi^2 (T. Hoffstra, pers. commun.).

Sex and Age Composition

Twenty-four bears were taken by Federal trappers between 5 May and 15 July 1982 from a second-growth redwood stand in northern Humboldt County (C. Mullis, ADC, unpubl. data). Seventeen of these were males. Based on this information, the sex ratio would be 2.42:1 in favor of males. Piekielek and Burton (1975) cited several examples from various authors who had examined data from captures of depredating bears. In every case, the sex ratio of captured depredating bears heavily favored males. Black bear management decisions are often based on sex ratios and age composition data secured from the literature, hunter-kill records and de-

exposed, the bears use their incisors to scrape off the sweet tissue. The striations and wounds are very diagnostic and cannot be confused with damage from woodrats (*Neatoma* spp.), gray squirrels (*Sciurus* spp.) or porcupines (*Erethizon dorsatum*) that also feed on redwoods. The degree of bear damage can be very limited (a single bite) or can be so severe that the entire base of the tree is girdled and the bark removed 60 to 80 feet above the ground. On these severely damaged trees, it appears that the only thing preventing the bears from removing all of the bark from the tree is the tree's physical inability to support the weight of the bear towards its apex.

Trees that do not die as a direct result of the damage tend to show a decreased ability to sustain growth levels comparable to undamaged trees (K. Stumpf, Simpson Timber Co., pers. comm., Poelker and Hartwell 1973). Furthermore, damaged trees are exposed to fungal, bacterial and insect infestations that can lead to the eventual death of the tree. Even if the tree is able to repair the wound with callus tissue, the overall timber yield of the tree may be reduced.

Other conifers are also susceptible to black bear damage. Such damage has been reported on white spruce, *Picea glauca* (Lutz 1949), and Alaska-yellow cedar, *Chamaecyparis nootkatensis* (Hennon 1987) in Alaska, balsam fir, *Abies balsamea* (Zeedyk 1957) in Maine, Douglas-fir in Oregon (Maser 1967) and Washington (Poelker and Hartwell 1973) and western larch, *Larix occidentalis*, in Montana (Mason and Adams 1987, W. D. Schmidt 1987).

In Del Norte and Humboldt Counties, black bears begin to feed on the cambium of redwood trees during the period between grass emergence and fruit ripening, between mid-May through early July. Bear scats during this period often contain substantial amounts of undigested wood fiber (G.A.G., pers. obs.) Sap flows are at their highest in the trees and the cambial layer is an attractive food source. Based on personal experience (G.A.G.), the layer of sap wood being fed upon has a distinctive sweet taste and is highly palatable. Although Douglas-fir is also common in Del Norte County, bear damage has only occurred on redwoods.

Scope of Damage

F. A. Glover (unpubl. data), in his report to the California Redwood Association, estimated that a single bear could damage as many as 20 trees in a 24-hour period. He went on to say that approximately 13% of those trees damaged suffered greater than 75% damage, which usually resulted in the death of the tree. Maser (1967), studying damage to Douglas-fir in Oregon, observed that "...twenty percent of the initial stand, representing 3% of the total stand, was lost by complete girdling. Partial girdling occurred to 40% of the initial stand, 6% of the total stand." Poelker and Hartwell (1973) reported on black bear damage to 17-25% of a Douglas-fir stand.

For the 1987 growing season, we measured and categorized trees damaged by bears in the Smith River area of Del Norte County according to size class. Trees sampled were located along a main travel road. All trees exhibiting damage were examined. A total of 109 trees were sampled over a 2-mile transect (Fig. 2). Trees between 11 and 20 inches diameter at breast height (dbh) received the most damage, but we were not able to determine whether this size class was selected to a greater degree than its availability. F. A. Glover (unpubl. data) reported that most trees damaged were between 6 and 11 inches dbh. Poelker and Hartwell (1973) cited several authors who found that bears often fed on trees between 6 and 15 inches dbh. Though no authors gave specific explanations for bears selecting trees in this size class, several possibilities seem probable. First, bears may be feeding on the size class of trees that are most abundant in thinned stands. Second, bears may be selecting trees that are an optimal size for climbing. A third possibility is that bears may be selecting trees as a function of either the ease at which the bark can be removed or the level or type of nutrients available.

Again, because of the extreme density of the understory vegetation in second-growth redwood forests, it is difficult to assess the total scope of the damage. Glover (1955) estimated that the average annual increment of damage was 6% and the incidence of cumulative damage was 11.6 trees/ac. Furthermore, he noted that 48% of the 234 damaged trees he measured had been damaged in previous years. In a report to the Del Norte County Board of Supervisors, C. Mullis (ADC, unpubl. data) reported damage to 633 trees in the Smith River

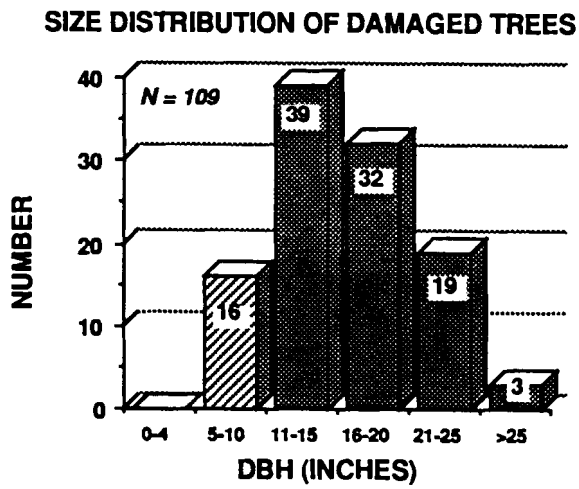

Fig. 2. Trees damaged in the Smith River area of Del Norte County according to size class in 1987.

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Because of the public's eagerness to find alternative solutions to control programs, a number of local environmental groups put forth the idea of supplemental feeding and plantings as an already tested and proven alternative. Initiating untested damage control measures such as supplemental feeding or planting on a large scale may exacerbate the problem or postpone the solutions. If foresters or landowners were forced to implement these programs before the basic research is undertaken, unacceptable damage levels could retard the search for viable alternatives. Educators, resource managers, environmental groups, and timber companies have a responsibility to work together in a professional manner in order to answer these questions and explain the results to an interested public.

APPLIED ENVIRONMENTALISM

With the exception of the work put forth by Flowers (1987), virtually nothing has changed in the approach toward alleviating black bear damage over the last 38 years. During the 1986-87 trapping season, it became quite apparent that public awareness has heightened and public attitudes are not apathetic toward damage control programs along the northern coast of California. What we see as a means of satisfying all parties involved is *applied environmentalism.*

Applied environmentalism is a give and take approach to natural resource management recognizing the economic, political, and practical nature of environmental degradation and which works to find real-world solutions to environmental problems. This approach must take uncertainty and surprise into account and allow for unpredicted effects, future technology, experimental approaches, and changing societal needs and economics. *Applied environmentalism* does not deny the existence of environmental problems and it does not deny the rights of property owners to make a living from their land.

As an example, the supplemental feeding strategy has been popular with the public, but has been met with skepticism by professionals. Critics have claimed that supplemental feeding would only encourage an artificially supported population. This, in fact, may be the case, but if feeding on conifers continues to occur during the May-June window of time (as has been reported during the last 30 years, Glover 1955, Poelker and Hartwell 1973), then the alternate food supplies need only be provided during that time. Secondly, though the theory of supplemental feeding has only limited applicability, because of the popular response, public agencies have a responsibility to at least address the issue. A full scale investigation may not be warranted, but enough consideration needs to be given to the approach to determine if it may have some merit in certain situations.

Bear-control critics need to be satisfied with current bear control techniques until new techniques are tested and available for field use. Bear damage foes must make a sincere effort to investigate alternate bear damage reduction methods. This way, forest management options which may be contributing to the conifer feeding behavior of bears can be isolated, discussed, and solved.

Solutions to this type of problem should not be the responsibility of a single agency. Rather, a mix of individuals representing industry, public resource agencies, environmental groups, and academic institutions should be providing input and money to address a problem of this scope. Leadership should be provided by organizations that already have an established network of communication. For *applied environmentalism* to work, the problem needs to be fully understood, information must be passed freely between those who are affected, and people and agencies must be committed to finding a research-based solution.

CONCLUSIONS

This paper has attempted to give a brief overview of an extremely complex situation; a problem of land owner rights, regional economics and wildlife values. The area of Del Norte and Humboldt Counties is faced with a serious problem of maintaining a viable economic base, while managing forests for wildlife, recreation and economic values.

A commitment must be made for: 1) basic research on black bear biology in redwoods; 2) economic analyses of bear damage to redwoods and bear damage prevention; 3) applied research on bear damage prevention techniques; 4) research on the interactions of timber management practices, black bears, and black bear damage; and 5) education for all parties on the need to have both bears and redwoods. This commitment must be initiated through cooperative efforts between resource agencies, private timber companies, environmentalists, and academic institutions. Only until the basic questions of black bear and redwood relationships are addressed can decisions be made that reduce economic injury caused by black bears. Furthermore, black bear management in the redwood region of California needs to be based on local information. With this commitment, a foundation for better natural resource management will be made.

ACKNOWLEDGEMENTS

We wish to thank L. Bradshaw, K. Stumpf, H. Pierce, T. Mansfield, C. Mullis, and W. Klein for their efforts with helping us obtain information used in this report. Their commitment to finding answers to difficult situations is commended. N. G. Tilghman provided us with valuable editorial suggestions.

_____. 1989. Vertebrate pest control and animal welfare. *In* K. Fagerstone and R. Curnow, eds. Vertebrate pest control and management materials: sixth symposium. ASTM STP. Am. Soc. Testing Materials, Philadelphia, Penn. In Press.

SCHMIDT, W. C. 1987. Bear damage-a function of stand densities in young larch forests? Pages 145-147 *in* D. M. Baumgartner, R. L. Mahoney, J. Evans, J. Caslick, and D. W. Breuer, eds. Proc. animal damage management in Pacific Northwest forests. Cooperative Extension, Washington St. Univ., Pullman.

STICKLEY, A. I., JR. 1961. A black bear tagging study in Virginia. Proc. Southeast Assoc. Game and Fish Comm. 15:43-52.

ZEEDYK, W. D. 1957. Why do bears girdle balsam fir in Maine? J. For. 59:731-732.