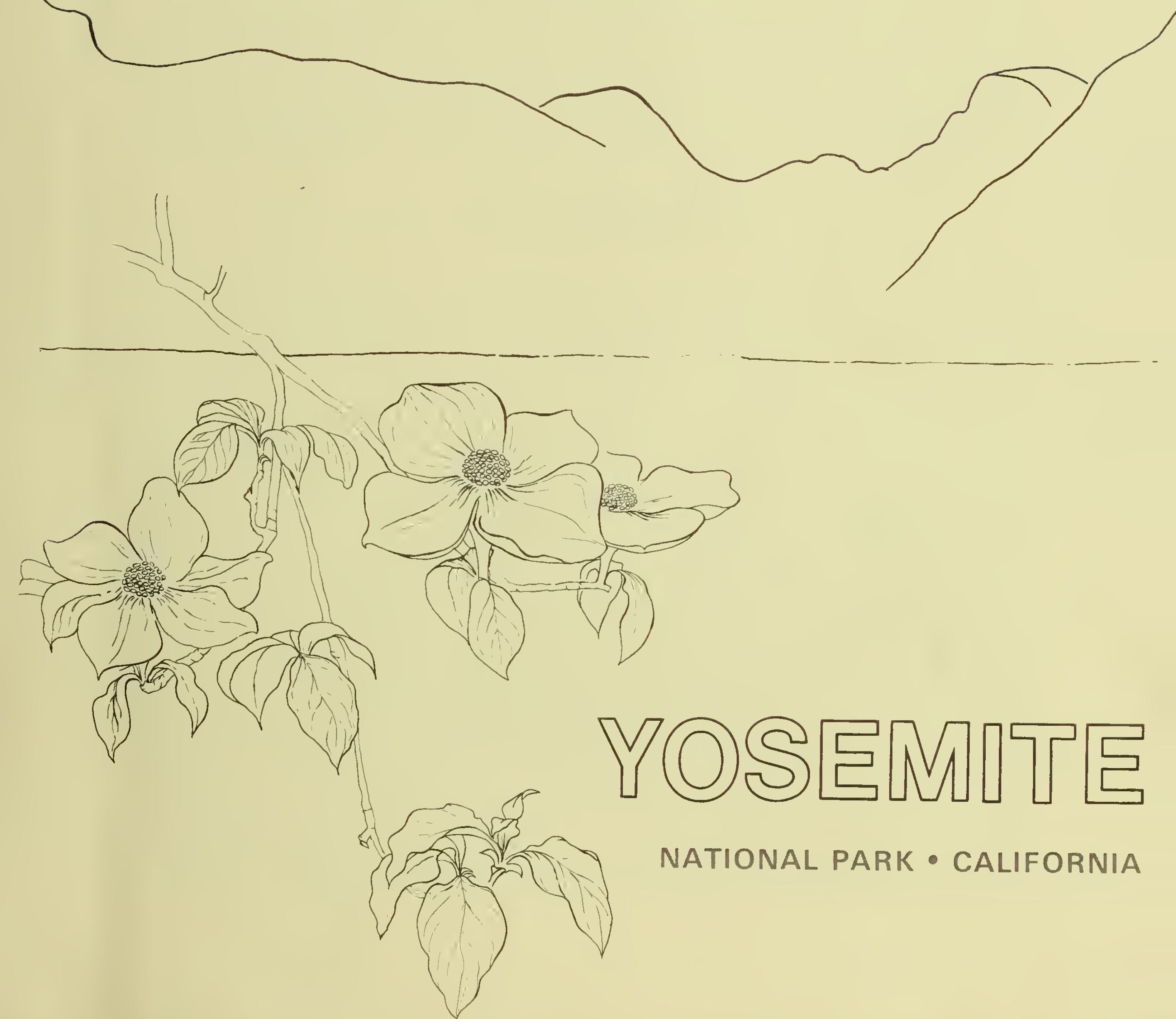
NATURAL RESOURCES MANAGEMENT PLAN

and

environmental assessment



YOSEMITE

NATIONAL PARK • CALIFORNIA

NATURAL RESOURCES MANAGEMENT PLAN

AND ENVIRONMENTAL ASSESSMENT

Yosemite National Park
California

Prepared by

YOSEMITE NATIONAL PARK
NATIONAL PARK SERVICE
DEPARTMENT OF THE INTERIOR

May 1977

View from Black Spring in 1866 (above) and 1974 (below).
Notice same rock in lower right of both photographs.

This comparison demonstrates the change that has occured primarily due to the suppression of fire, and illustrates the need for management of vegetation.

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I. DESCRIPTION OF THE PROPOSAL

A. Introduction: Yosemite National Park is situated in a region dominated by the Sierra Nevada (Figure 1). The Park's geological, biological, and scenic resources are exceptional in both type and quality. Since it was first visited by non-Indians in 1851, and set aside as a Park in 1864, Yosemite has attracted more and more people--reaching a peak of 2.7 million visitors in 1976. To the visitor, the unique resources which comprise Yosemite seem much the same as they were 125 years ago. Nevertheless, the long-term effects of fire suppression, visitor use, insect control, construction of facilities, and varied management practices in and adjacent to the Park have brought about gradual changes in the total Park environment. In certain areas, especially Yosemite Valley, the sequoia groves, the mixed-conifer forests, and some high elevation meadows, the ecological balance has been altered. In spite of the above, evidence indicates that the wildland portions of all ecosystems can be largely restored or maintained with implementation of sound management.

The objectives for resource management are:

RESTORE AND MAINTAIN NATURAL TERRESTRIAL, AQUATIC, AND ATMOSPHERIC ECOSYSTEMS SO THEY MAY OPERATE ESSENTIALLY UNIMPAIRED.

Conduct continuing research to gather and analyze information necessary for managing natural resources.

Restore altered ecosystems as nearly as possible to conditions they would be in today had natural ecological processes not been disturbed.

Protect threatened and endangered plant and animal species and reintroduce, where practical, those eliminated from the natural ecosystems.

Identify and perpetuate all natural processes in Park ecosystems.

Permit only those types and levels of use or development that do not significantly impair Park natural resources, and direct development and use to environments least vulnerable to deterioration.

Limit unnatural sources of air, noise, visual and water pollution to the greatest degree possible.

figure 1

Location map of Yosemite National Park

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PRESERVE, RESTORE OR PROJECT THE SIGNIFICANT CULTURAL RESOURCES (HISTORIC AND PREHISTORIC)

Identify, evaluate and determine the significance of cultural resources, encompassing buildings, structures, sites, and objects.

Provide for the preservation, restoration or protection of these significant cultural resources.

Permit only those uses which are compatible with the preservation of significant cultural resources.

Identification and recommendations for use and preservation of significant cultural resources will be covered in the General Management Plan. Objectives listed above that apply to cultural resources are pertinent to the Natural Resources Management Plan only as they ensure preservation of those resources.

Therefore, the primary objective of resources management will be the perpetuation of the natural processes which have had a dynamic influence on the development of the Park's ecosystems. This will be accomplished by restoring altered systems as nearly as possible to the conditions that they would be in today had ecological processes not been disturbed and, when practical, by reintroducing species which have been eliminated from the natural systems. In heavy use areas, such as Yosemite Valley and developed sites, additional management programs will be utilized to simulate natural processes, restore natural settings, and provide protection for the visiting public.

This, then, is a plan for the restoration and maintenance of the total environment rather than the piecemeal protection or management of selected features or species. As such, vegetative management represents the prime thrust of this plan, since vegetation, primarily a product of climate and soil, largely determines the composition and density of the dependent animal resources. As vegetative communities depart from the natural or pristine, so also are the animal resources altered.

All development and the use that Park ecosystems receive results in some departure from the natural state. Besides the immediate site, the affected area often includes a considerable portion of the surrounding environment. Adverse influences include the aesthetic impact of development on the wildland environment along with the physical and biological impacts of increased human use and that of support systems such as water, sanitation, solid waste collection, power, communication, and transportation. The above influences lead to changes in animal and plant density and distribution; soil compaction and erosion; alteration of stream flows and ground water levels; drainage; lowering of water, air and noise quality levels and unauthorized acts including use and release of toxic chemicals, introduction of exotic species, and removal of native species. Though relationships are less clear, at some point increased visitor use and/or physical and biological impacts will result in sociological impacts.

Measures designed to mitigate the above listed impacts include: hazard tree removal, forest pest control, river clearing, revegetation work, exotic plant control, bear management and vector control. To a lesser degree all other natural resource management programs are attempts to mitigate past or present use or development in or near the Park. It follows that preservation of natural resources can best be accomplished with a minimum of development and use. And without controls on each, preservation of natural resources will be impossible.

Bear management objectives, techniques, and operations described in this Natural Resources Management Plan and Assessment concur with those expressed in the more detailed and approved Human-Bear Management Plan. Impacts and alternatives of the latter plan are covered in the Assessment portion of this document.

B. Vegetative Resources Management

1. Environmental Restoration: The most pervasive influence of man on the vegetation of the Park has been the suppression of naturally occurring fires. According to Agee (1973): "The presence of fire in past centuries in western forests is considered to be well-established. Surface fires were thought to be a common occurrence in the mixed-conifer region of California, and forests were quite open compared to their present condition."

   Attempts to suppress fires began before Yosemite National Park was established, and by 1910, an effective suppression program was emerging. This has led to an increase in the density of the understory trees and a shift in the botanical composition of the vegetative mosaic away from the more fire resistant species. This effect is most pronounced in the mixed-conifer forests where ponderosa pine (*Pinus ponderosa*) and sugar pine (*Pinus lambertiana*) are being replaced by incense-cedar (*Libocedrus decurrens*) and white fir (*Abies concolor*).

In summary, the mixed-conifer and sequoia (Sequoiadendron giganteum) forests particularly, and vast portions of other Park forests, have been adversely influenced by fire suppression. To rectify these imbalances, the natural roles of fire will be restored to all ecosystems. Kilgore (1972) lists these roles: (1) seedbed preparation; (2) recycling of nutrients; (3) setting back plant succession; (4) providing conditions favorable for wildlife; (5) providing a mosaic of age classes and vegetation types; (6) reduction of numbers of trees susceptible to attack by insects and diseases; and (7) reduction of fire hazard.

The management program is designed to recreate the vegetative mosaic which would have existed today if the unnatural influences of modern man had not intervened. Various fire management techniques will be employed to accomplish this objective, although other techniques will also be used.

In the past, attempts to restore natural conditions were limited to the mechanical removal of small trees, which were encroaching upon meadows and California black oak (Quercus kelloggii) woodlands. Prescribed burning has been used to treat 5,608 acres since 1970, primarily in Yosemite Valley and near Wawona. The scope of the fire management program will be broadened considerably in order to treat the more than 280,000 acres in need of restoration (Figure 2).

The program will be accomplished in two phases. The first phase or intensive phase, will concentrate on unique ecosystems and areas of high visitor use. These areas comprise approximately 10,000 acres and include the Mariposa, Tuolumne and Merced giant sequoia groves, stands of sugar pine in the Rockefeller Grant, Yosemite Valley, Wawona, and areas adjacent to main Park roads. Good accessibility and the opportunity to use roads to delimit areas into small burn units and operate fire apparatus render them easy to burn. The extensive phase will be designed to treat the remaining acreage, approximately 270,000 acres and will employ various ignition and burning patterns including area ignition. This phase will be initiated after burning in the intensive phase is being handled on a routine basis.

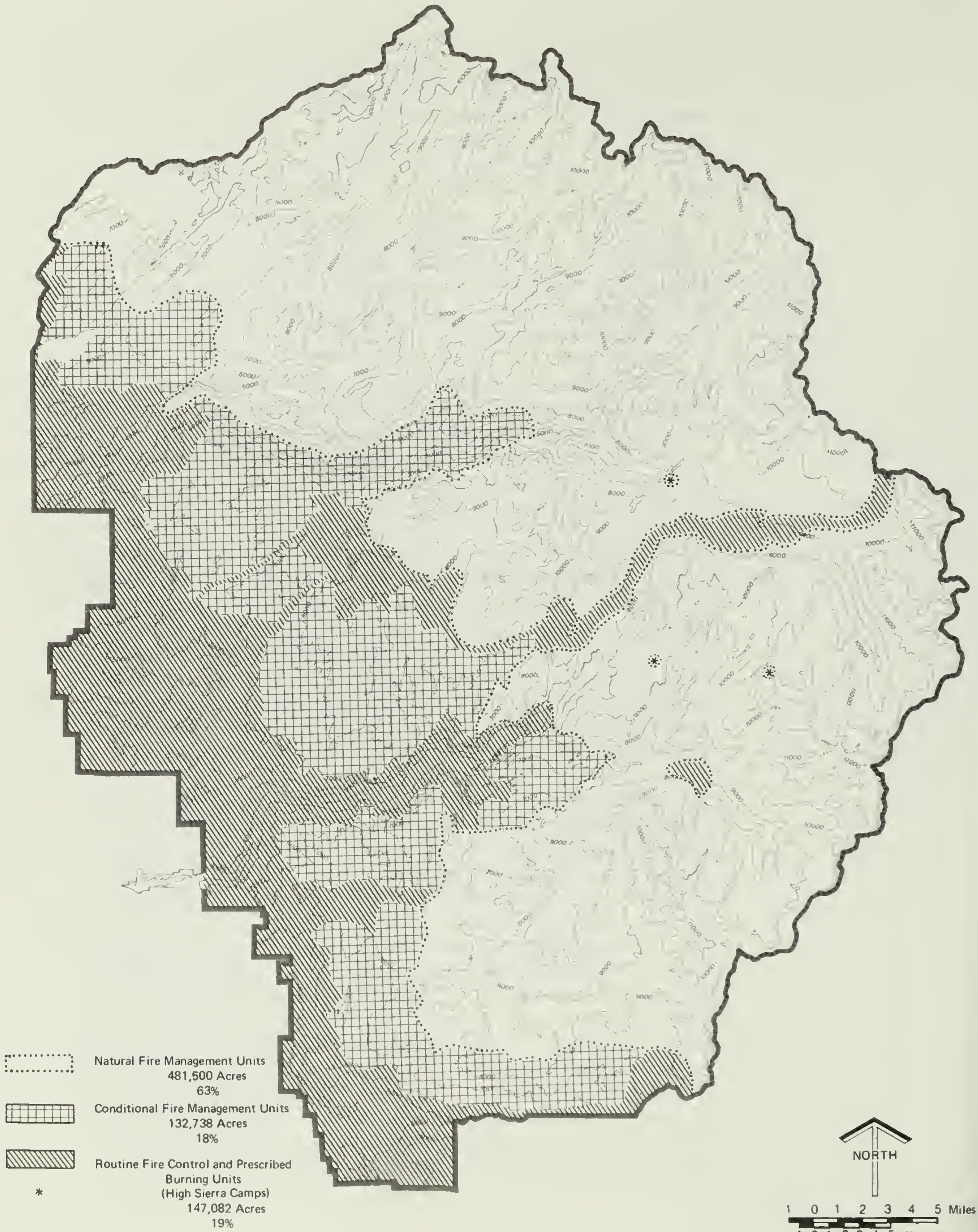

figure 2

Fire Management Units

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With use of proper prescriptions and burning techniques, the resulting low intensity fires will reduce the highly flammable, dead fuel layer and kill small, understory trees. Such fires are normally confined to within three or four feet of the ground and have no tendency to "crown", i.e., run through treetops. Accordingly, their effect on large trees is minimal over the short-term and beneficial over the long-term.

Burn units will be selected to utilize as many natural barriers as possible. These include open ridges, rock outcrops, cliffs, streams, snow line, discontinuities in fuel type and fuel moisture and wet meadows. Man-made barriers such as roads, trails, and hand lines will also be used.

Slope is an important factor in determining which burning technique will be best for a particular area. Backing-fires or strip-fires are best used on dry slopes where a headfire would result in a fire of too great an intensity. Headfires are best on moist, north facing slopes.

In extensive burn exposures, fuel types, fuel moisture and fuel loading may vary so much that local differences in fire behavior may be expected even though test plots are within prescription. This variation contributes to the desired vegetative mosaic and presents no problem as long as the overall fire intensity and behavior remain within acceptable limits.

Weather data will be recorded at least twice daily at the burn site for five days prior to burning and continued until completion of the burn. Trends in weather and prescription parameters will be monitored frequently. If there is a rapid drying trend in the spring, conditions may soon be out of prescription. If the trend indicates that prescribed conditions may be lost within one or two days, ignition will be postponed.

Area ignition will be one of the techniques used for carrying out the large burns required for environmental restoration. This technique permits a relatively large burn to be ignited and speedily completed under the best combination of burning, holding, and smoke dispersal conditions, and at a time when the short-term forecast is for milder burning conditions. As a result annual burning requirements will be accomplished in a relatively short time in spring and fall with minimal impact to the public and air quality.

The Park will cooperate with involved County Air Pollution Control Districts, and generally air quality will be protected by burning during conditions which permit smoke dispersal into the upper atmosphere. To the extent possible, wind direction will be used so as to direct smoke away from roads and highways.

The locations of all proposed or designated threatened or endangered plants have been mapped. Before any burn plan will be approved the Prescribed Fire Committee must be assurred that the burn presents no threat to any such plants. Should any such plants be discovered after a burn was in progress they would be adequately protected or the burn suppressed.

Research concerning the role of fire in the various ecosystems of the Park will continue in order to give the program a solid scientific base. Of particular research interest, will be the dynamic nature of fire in perpetuating the various vegetative mosaics, and also, the effects of aboriginal man on the vegetation of the Park.

In the giant sequoia groves, the specific objectives are to check and correct the unnatural shifts from the pristine, open grove condition to that of the present, dense, white fir-dominated understory. Historical photographs will guide the work. Techniques to be used will be cutting, piling, and burning, followed by use of prescribed fire (Figures 3a, b and c).

The sugar pine stand on the Rockefeller Grant will be managed to restore the original open condition and to reduce the unnatural accumulation of fuel, which threatens the stand. Once this is accomplished, natural processes can be permitted to run their course. Prescribed burning and direct tree removal will be employed.

1915

1969

1970

(after environmental restoration with understory removed by cutting).

figure 3

Photographs of Galen Clark Tree and environs in Mariposa Grove in 1915, 1969, and 1970.

The restoration of a relatively open condition is the primary objective of the program in Yosemite Valley. Photographs have shown how the forests of the Valley floor have extended their boundaries and how the open stands of the California black oak have been over-topped by the conifers. Prescribed burning and direct removal techniques of cutting, piling, and burning will be used to accomplish this objective.

Areas adjacent to the main Park roads are seen by everyone traveling through the Park. These areas will serve as the showcase for the environmental restoration program and warrant intensive management. In addition, roadsides are high fire risk areas, and management to reduce fuel hazards is important. The removal of trees for aesthetic purposes and prescribed burning will be the primary manipulative techniques.

At elevations above the mixed-conifer forests, plant communities, with the exception of meadows, have been much less altered by man and respond to more passive management. Here, the ecological roles of fire can be restored simply by delineating Natural Fire Units and allowing naturally occurring fires to burn. Unit boundaries are established on natural barriers, so there is little chance for fires to burn outside designated areas.

Conditional Fire Management is an intermediate type. Units so managed generally lie elevationally between the Natural Fire and Prescribed Burning Units. During the regular fire season, all fires are suppressed. However, between fall and spring, when certain prescribed conditions are met, naturally occurring fires are allowed to burn. Within these Units, management also has the option to ignite fires and allow them to burn when the interval between fires has been unnaturally long as a result of suppression activities. As in Natural Fire Management Units, control or suppression of these fires can be undertaken at the discretion of management.

Outside of Natural Fire Management Units, fairly large-scale environmental restoration can be achieved by loose-herding and holding certain wildland fires of natural origin to pre-selected management units. Selection of fires to receive such treatment would depend upon fuel load in, and adjacent to, the selected area; current and projected weather conditions; season of year; existing fuel discontinuities; visitor-use level; availability of an adequate suppression force; and jurisdiction of adjacent lands. Important benefits would be primarily those resulting from fire operating in its natural role and the economy of treatment.

Wildland fires constitute a threat to public safety and property. Also, while fires of natural and Indian origin constituted no serious threat to resources during the pristine period, today wildland fires can seriously damage the natural environment under certain fuel, topography and weather conditions. Accordingly, Wildland Fire Control, though greatly scaled down in scope, is still an important activity in the lower elevational belt that coincides with the area devoted to prescribed burning. In addition, it is seasonally applied to Conditional Fire Management Units and all developed areas.

For the above reasons, the need for a wildland fire organization and program is expected to persist into the foreseeable future. With planned environmental restoration, the scope of this program should eventually decline to a point where the need for resource protection would have declined appreciably and the protection of people and property would be its primary function.

Various factors have led to the reduction of meadow areas of the Park. The absence of naturally occurring fires has allowed woody vegetation to encroach upon meadows within the mixed-conifer zone. The lowering of water tables through the removal of moraines, drainage and river channelization, has led to drier conditions and subsequent invasion by trees in Yosemite Valley meadows (Gibbons and Heady, 1964). Less is known about the high country meadows. Over-grazing by domestic sheep and later recreational stock, trail erosion and fire suppression activities have probably accentuated the natural meadow successional trend.

The thrust of this program is to reintroduce those natural mechanisms which control meadow succession. The distinction should be made, however, that the objective is not to maintain the meadows in static or historic condition, but rather to restore them to what they would have been like today without technological man's interference. The cultural effects of Indian burning will be maintained where appropriate. Past efforts have ranged from the sporadic removal of small trees from meadows to the prescribed burning of high country meadows.

Initially, this program will confine active management to those meadows where the knowledge of their pristine condition exists. Methods which simulate natural processes such as prescribed burning will be used as necessary. The meadows in Yosemite Valley will receive primary attention, as will Big Meadow and Wawona Meadow.

Yosemite Valley meadows will be burned on a rotational basis every three to eight years. Although spring burns will be used initially, burning at other appropriate times will be accomplished as the program develops. It is hoped that this program would be in conjunction with the Indian Cultural activities of the Interpretive Division. Some trees will be removed mechanically in conjunction with vista clearing projects.

No prescribed burning will be carried out in high country meadows until an ecological rationale, based on research, is developed. Research will be designed to gather this data base and to develop restorative techniques.

With the exception of several forbs and a number of grass species, few exotic plants have become established or are reproducing in the Park outside of Yosemite Valley. Most non-native trees are associated with early developed areas and are not a serious problem since they are not reproducing. A more subtle effect is that of native trees which have come from plants or seed sources outside the Park. These species can hybridize with native ecotypes, thereby contaminating the local gene pool.

The exotic plant control program will entail elimination of all uncultivated, non-native, woody plants; limiting the extent of, and where feasible, eliminating exotic herbaceous plants and prohibiting the introduction of any non-native plants in the future. The only exception to the above would be the preservation of exotic woody plants of recognized historical significance.

2. Maintenance Programs Involving Vegetative Resources

a. Hazardous Tree Removal: For the past 20 years between 600 and 850 live and dead trees have been felled and removed annually in developed sites and along roadsides. Hazardous limbs have been removed from an additional 200 trees annually on the above sites. These trees die or become structurally weak as a result of (*Fomes annosus*), (*Armillaria mellea*) and other native fungi, mechanical injury, flood, avalanche, lightning, windstorms and old age. Such dead or weakened trees are subject to failure especially during storms, and constitute a serious hazard to people and property in developed areas.

Within the last few years, tree failures have killed and injured visitors, destroyed and damaged expensive buildings, tents, cars, powerlines and blocked roads. Organized control work began here about 1935. Since then, almost 16,000 hazardous tree situations have been rectified.

Recent research on (Fomes annosus) indicates a need to remove as many as 230 additional trees in Yosemite Valley annually. This will increase the total number of trees to be removed Parkwide to between 850 and 1,080 annually.

Required tree removal in old annosus infection centers has resulted in five openings in forested, developed sites which now lack adequate shade and screening for the use they receive. These sites will be revegetated with nonsusceptible or resistant native vegetation obtained within the Park.

b. Plant Propagation and Revegetation Program: All trees and shrubs eventually die. In the wildland environment replacement is governed by natural processes and is generally assured. Developed areas, on the otherhand, exist in a vastly less natural condition. In the latter areas, this departure from natural conditions is due to the concentrated level of human use that occurs, land preempted by development, resultant inhibition of natural processes and the introduction of foreign substances, and other influences. The sum total of these effects frequently prevent or greatly inhibit vegetative reproduction, and as trees and shrubs die, they are not replaced. The longterm forecast for such sites is a loss of woody vegetation, and such losses eventually render sites undesireable for their selected use. To avoid such impacts and the alternative ones of abandoning or relocating such developments, a revegetation program is needed. Seeds, seedlings and cuttings of native species will be collected in the Park and cultivated in nurseries in or near the Park. Vegetation so obtained will be planted in developed and construction sites as needed. Protective fencing, fertilization and watering will often be required during the early stages of growth.

c. River Clearing: Fallen trees are frequently picked up by the Merced River during high water periods and form logjams that threaten Yosemite Valley's low bridges and some other facilities. To alleviate this problem, sporadic log clearing has been carried out for many years and has been a regular activity since 1965.

Most logs, stumps, and large tree debris will be removed from the Merced River between Happy Isles, Mirror Lake and the Pohono Bridge. Also, trees along the bank in imminent danger of falling into the river will be felled and removed. Work will be carried out twice each year--during the low water period in fall and before the high water period in spring.

d. Vista Clearing: Accelerated vegetative succession resulting from long-term wildland fire suppression has permitted woody vegetation, especially conifers, to encroach and occupy a tremendous acreage formerly occupied by meadow, brush, and black oak woodland. On certain sites, which formerly afforded significant scenic views, encroaching vegetation will be mechanically removed to maintain vistas. However, the ultimate objective is to restore the natural regulation of these ecosystems to the extent that there will be no need for vista clearing. It is, therefore, only a transitional measure.

Limited vista clearing was carried out by early settlers in Yosemite Valley prior to 1880. It was a regular activity during the CCC period of the 1930's, and in a more limited manner up to 1961, when priorities changed. Since the 1940's, funding for this activity has always been extremely limited and never on a recurring basis.

All trees removed in the three previously described programs will be declared surplus and be disposed of in accordance with Federal laws and procedures.

3. Forest Pest Control

a. Fomes annosus: This native fungus is the most important pathogen of coniferous trees in Yosemite Valley, infection centers being found in both wildland and developed portions of the Valley (Figure 4). Although there is no problem in the wildland forest, annosus is a serious problem in developed areas and the greatest source of hazard trees in Yosemite Valley (Figure 5). There, when infected, trees become structurally weak and hazardous to people and property they must be removed. Remedial work is very costly and involves annual inspections; and rigging, topping and felling of hazardous trees.

Only recently has the problem been adequately recognized and researched. Prior to that, development clearing, mechanical injury, and required cutting of bark beetle-infested and hazardous trees over a long timespan without

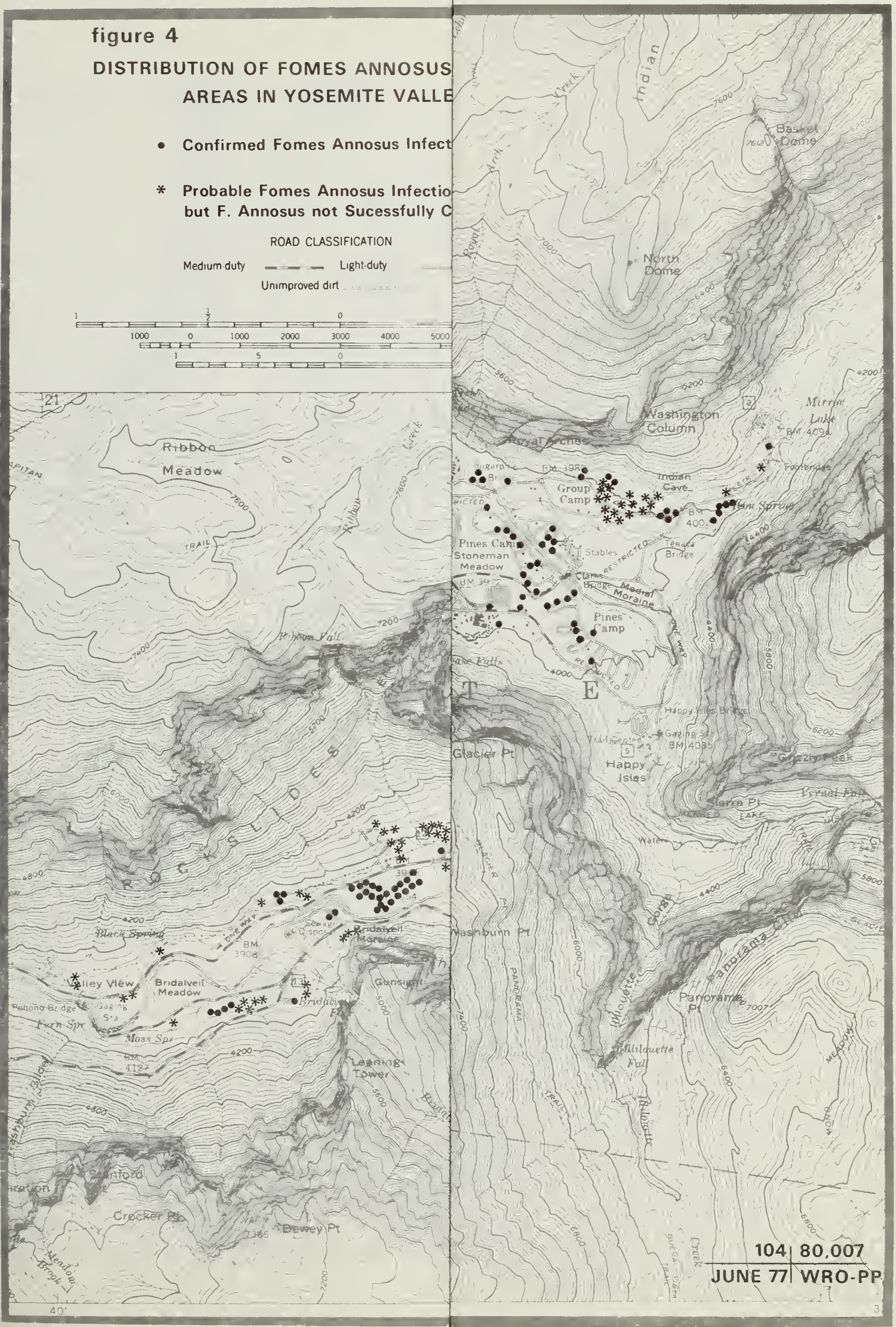
figure 4
DISTRIBUTION OF FOMES ANNOSUS
AREAS IN YOSEMITE VALLE
• Confirmed Fomes Annosus Infect
* Probable Fomes Annosus Infectio
but F. Annosus not Sucessfully C
ROAD CLASSIFICATION
Medium-duty
Light-duty
Unimproved dirt
Indian
Basket Dome
North Dome
Washington Column
Royal Arches
Mirror Lake
Ribbon Meadow
Indian Cave
Group Camp
Pines Camp
Stoneman Meadow
Stables
Tenaya Bridge
Medial Moraine
Ribbon Fall
Happy Isles
Glacier Pt
Grizzly Peak
Sierra Pt
ROCK SLIDES
Black Spring
Valley View
Bridalveil Meadow
Pohono Bridge
Fern Spr
Moss Spr
Washburn Pt
Panorama Pt
Illilouette Fall
Leaning Tower
Stanford
Crocker Pt
Dewey Pt
Meadow Brook
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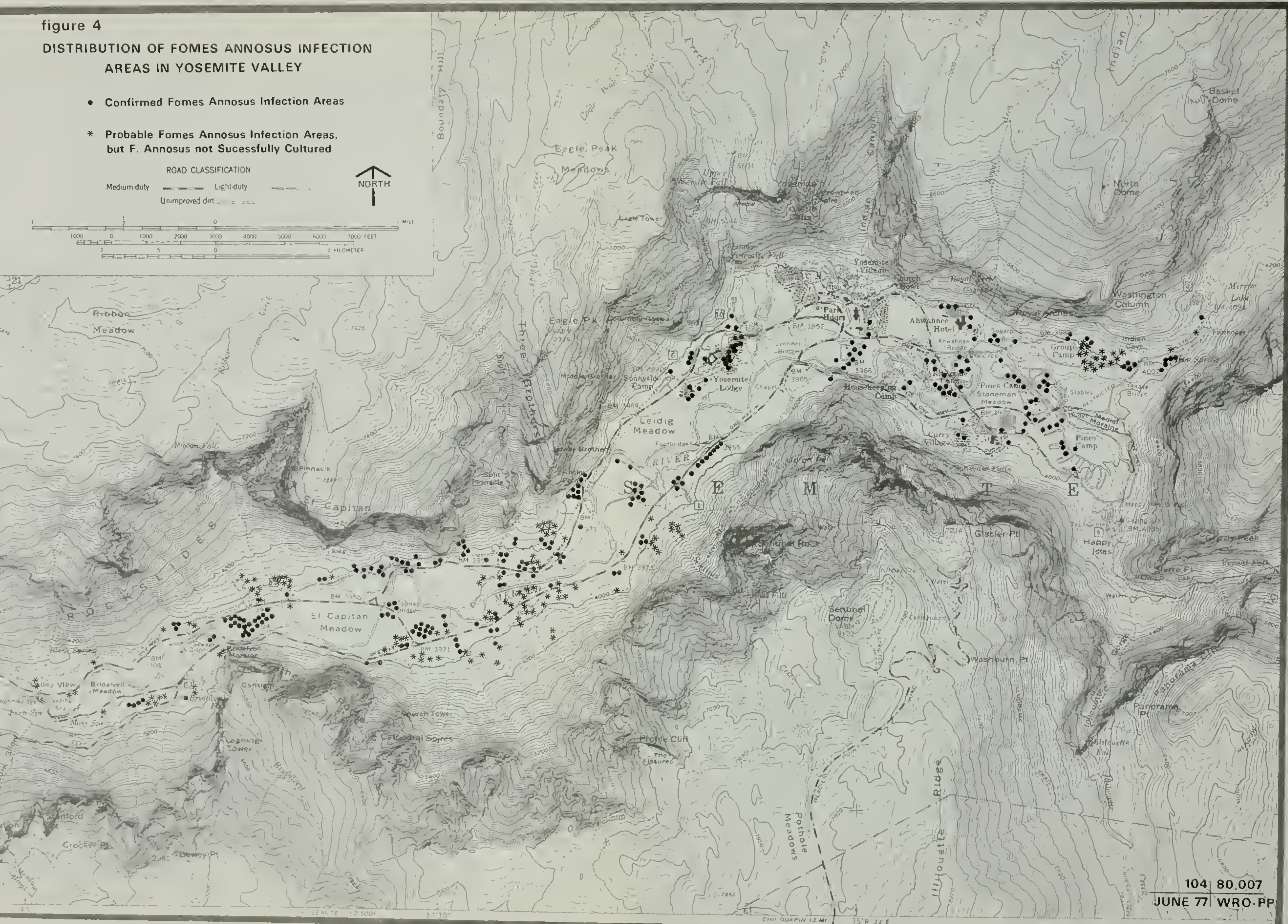

figure 4
DISTRIBUTION OF FOMES ANNOSUS INFECTION AREAS IN YOSEMITE VALLEY

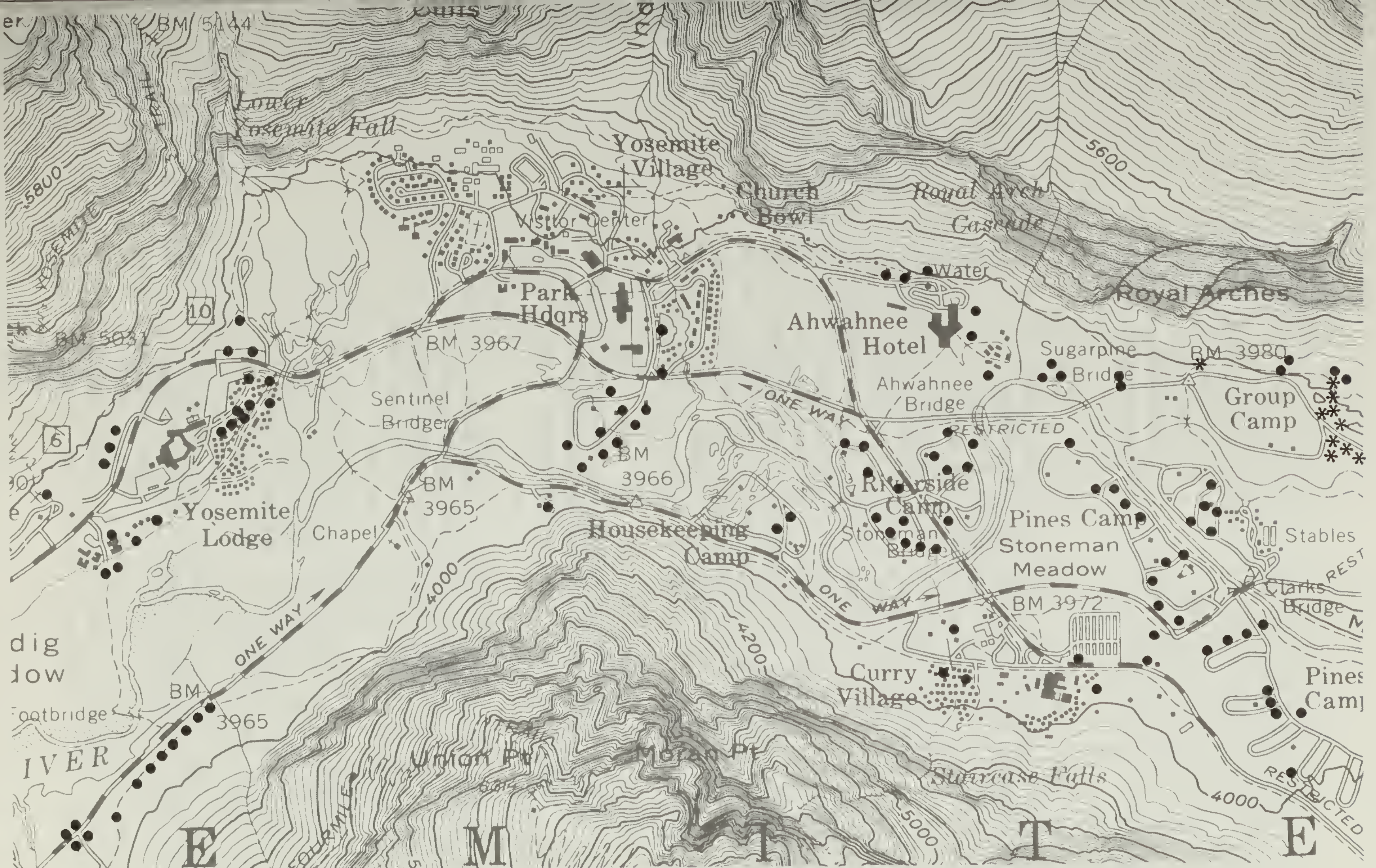

figure 5

DISTRIBUTION OF FOMES ANNOSUS INFECTION AREAS IN MAJOR DEVELOPMENT IN YOSEMITE VALLEY

- • Confirmed Fomes Annosus Infection Areas
- * Probable Fomes Annosus Infection Areas, but F. Annosus not Sucessfully Cultured

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immediate protection of the stumps has permitted airborne annosus innoculum to enter stumps and establish new infection centers. Centers spread and intensified through root contact between trees. Then too, increases in tree density in the absence of natural fire has produced numbers of suppressed trees predisposed to attack by forest pathogens such as annosus.

Since 1969 we have required stumps resulting from any tree felling operation to be treated within one-half hour with technical grade borax, the recommended protection agent. However, a number of developed areas supporting heavy annosus infections occur in Yosemite Valley. Taken together, they represent one of the largest areas of pine and incense-cedar infection by annosus in the State and possibly throughout the western states. Recent research has revealed the existence of 99 confirmed annosus infection centers in Yosemite Valley developed areas. Spread from center perimeters through root contact is calculated at two to three feet yearly. Pathologists predict that within the next 25 years there may be no mature conifers left in some Valley developed areas. No control of this pathogen has been tested and validated.

Annosus mortality is responsible for the large hazard tree cut carried out in the Valley developed areas each year. A small additional number of trees fall annually as a result of root rot, butt weakening or mortality by annosus.

b. White Pine Blister Rust: Although unknown here prior to 1971, control work to prevent establishment of the exotic blister rust from sources further north began in 1933. From that date through 1967, work consisted primarily of elimination of certain species of the genus Ribes, which are intermediate hosts of the exotic, rust-producing fungus (Cronartium ribicola). In 1968, when pathologists became convinced that indirect control was ineffective, emphasis here switched to detection surveys.

In 1971, four small infection centers were located; but to date, only a few small sugar pine have been infected. However, if infection centers intensify, many small sugar pine will be killed. Also, there is a long-term possibility that too few young sugar pine will survive the vulnerable size class to maintain the present density and distribution of the species. However, due to the demonstrated resistance of certain trees and apparent ecologically rust-free sites, most pathologists agree that the rust is permanently established in Sierran forests, but far less threat to sugar pine than formerly believed. Pathologists have no tested control program and recommend none. Consequently, no blister rust control program is proposed at this time. However, surveys to determine the distribution and intensity of blister rust infections will be carried out periodically.

If blister rust becomes widely established, we will propose a study by forest pathologists to determine its role and possible long-term effects on the ecosystem.

c. Bark Beetle Control: Native bark beetles of the genus Dendroctonus, attack and kill pine throughout the latter's range. In all but developed sites, this is viewed as a natural process requiring no control. However, in the latter sites, infested trees sustain beetle populations that can and do attack adjacent healthy trees. This is most prevalent where trees are weakened by (*Fomes annosus*), other fungi, mistletoe, mechanical injury or overstocking. Upon death, all these trees become hazardous by virtue of location. Control consists of identification of infested trees, felling, and treating the bark with an approved chemical to kill beetles, larvae and eggs.

Although formerly extensive in cost and scope, the current program is quite limited. Since 1975, Service policy has limited control to four specific situations. Only one, "...for reasons of public health and safety...," applies to the Yosemite situation. Thus, control is limited to developed areas. Funds are in the form of a special appropriation in compliance with the Forest Pest Control Act of 1947 (61 Stat. 177). Since 1970, the funds have ranged between $18,100 and $34,500 annually.

d. Lodgepole Needleminer Control: Vast forests of lodgepole pine (*Pinus contorta*) in the upper watersheds of the Merced and Tuolumne Rivers support the native lodgepole needleminer (*Coleotechnites milleri*). Due to the almost monospecific composition of these forests, needleminer populations periodically achieve epidemic proportions, killing lodgepole pine over extensive areas. Control efforts began in 1949, and became fairly extensive during 1959, 1961, and 1963.

Service policy adopted in 1967, regarding forest insect and disease control, resulted in the former program being abandoned. In terms of the above listed policy and the revised policy of 1975, the needleminer is considered to be a natural biological factor in the lodgepole pine-subalpine ecosystem.

If further epidemics should threaten to kill all or virtually all mature lodgepole pines within the Tuolumne Meadows and Tenaya Lake developed areas, several alternatives will be given full consideration. These range from taking no action to closing and/or relocating campgrounds and other affected facilities; employing various acceptable chemicals to control the needleminer in, and in one case, near the developed areas; biological control with an acceptable agent; revegetating developed areas with nonsusceptible native conifers and combinations of the above.

e. Other Insect Pests: We propose to attempt complete removal of any exotic insects threatening to become established in the Park, provided that suitable control measures are available. Besides effectiveness on the target species, suitability depends upon an acceptable level of impact on the total ecosystem. Service policy permits control of other native insects only in the following context:

(1) To prevent the loss of the host or host-dependent species from the ecosystem.

(2) To prevent outbreaks of the insect or disease from spreading to forests, trees or other vegetative communities, or animal populations outside the Park.

(3) For reasons of public health and safety.

(4) A suitable control method is available; suitable being defined as in (e) above.

No plans for any such actions are entertained presently.

4. Grazing Management: Most horse and mule use within the Park occurs close to developed areas with stock being held in corrals overnight and fed without any grazing taking place.

The legitimate grazing which does occur results from horses, mules and burros used to transport people and equipment to distant backcountry destinations. Although stock users are encouraged to pack complete rations for all animals it is not required, and considerable grazing takes place. However, all such grazing must be incidental to a recreational trip in the Park or, in the case of the Government, necessary to carry out trail and general maintenance, protection patrols and resource surveys and work. The following is a breakdown by users:

Type of User	Number of Animals Used	Animal Unit Months of Use
Private	2,586	224
Concessioner	60	183
8 Commercial Packers Operating under Government permit	149	5
Government	82	42
TOTALS	2,877	454

Since grazing represents only 1.4 percent of the total back-country use and is distributed over several thousand acres, it has very little adverse effect on vegetation, soil or water. However, in those few places where it is concentrated due to the popularity of an area, damage to vegetation, soil and water does occur.

The management of Yosemite's grazing resources will be guided by ecological principles. Surveys to inventory, set grazing capacities and monitor programs will be required. Proper resource utilization requires removal of a number of drift fences which confine stock to overused areas and the maintenance and/or relocation of other such fences. Grazing adjacent to the Park requires four and one-half miles of boundary fencing in selected areas to exclude livestock trespass.

Meadow damage and general soil movement also results from improperly designed and/or located trails and inadequate maintenance. Corrective measures will include approximately nine and one-half miles of trail reconstruction with annual maintenance and soil stabilization and abandonment of old improperly located trails.

Table 1. Threatened and Endangered Plants

SPECIES	STATUS		
	Federal/1	State/2	Park/3
Asteraceae (Compositeae)			
Eriophyllum nubigenum var. nubigenum Yosemite eriophyllum	endangered	possibly extinct	endangered, possibly extinct
/5 Eriophyllum nubigenum var. congdonii Congdon's eriophyllum	threatened	rare	threatened
/4 Artemesia cana ssp. bolanderi Should be listed as below: Chrysothamnus parryi bolanderi	threatened	--------	threatened
Cyperaceae			
Carex whitneyi Whitney sedge	threatened	endangered	threatened
Fabaceae (Leguminosae)			
/5 Lupinus citrinus var. citrinus	threatened	rare	threatened
/5 Lupinus citrinus var. deflexus	threatened	rare	threatened
Trifolium bolanderi Bolander clover	threatened	rare	threatened

/1 Federal status of threatened species is under review (Federal Register, Vol. 40, No. 127, Part V. July 1, 1975); endangered status is proposed (Federal Register, Vol. 41, No. 117, Park IV. June 16, 1976).

/2 State list from Inventory of Rare and Endangered Vascular Plants of California, Spec. Pub. No. 1, California Native Plant Society. 56 p.

/3 Park list developed by Dr. Carl W. Sharsmith, Emeritus Professor of Botany, California State University - San Jose and a recognized authority on Yosemite vascular plants.

/4 Corrected on September 9, 1976 by Sharsmith, who first listed it as Artemesia cana ssp. bolanderi.

/5 Species known to occur close to boundary of Yosemite National Park and possibly occurring within the Park.

SPECIES	Federal[/1]	State[/2]	Park[/3]
Liliaceae (Amaryllidaceae)			
Allium yosemitense Yosemite onion	threatened	rare	threatened
Erythronium tuolumnense Tuolumne fawn lily	threatened	endangered in part	----------
Onagraceae			
[/5] _Clarkia lingulata_	threatened	rare	threatened
Portulacaceae			
Claytonia bellidifolia spring beauty	threatened	rare	threatened
[/5] _Lewisia congdonii_ Congdon's bitterroot	threatened	rare	threatened
Lewisia disepala Yosemite bitterroot	threatened	rare	threatened
Sarraceniaceae			
Drosera rotundifolia round-leaved sundew	---------	rare	----------

Table 2. Plants of Limited Range or Those Whose Status in Yosemite is Undetermined

Studies to determine current distribution and status and to guide future management and protection will be carried out.

sedge	*Carex sartwelliana*
chickweed	*Cerastium beeringianum*
chaenactis	*Chaenactis alpigena*
shooting-star	*Dodecatheon subalpinum*
fleabane	*Erigeron vagus*
gentian	*Gentiana tenalla*
Greek valerian	*Polemonium pulcherrimum*
willow	*Salix nivalis*
saxifrage	*Saxifraga debilis*
speedwell	*Veronica cusickii*

Past grazing abuse has resulted in some local resource degradation and unnatural invasion of meadows by lodgepole pine. Remedial measures include erosion control with check dams in gullies, removal of invading pines, and installation of regulatory signs.

All stock pasturage not incidental to a recreational or management trip will cease after 1977. This will affect only the concessioner and just the Wawona area.

5. Threatened And Endangered Plants: The known habitats of the species listed in Table 1 below are recorded, mapped and included in the Resources Basic Inventory of the Park. These habitats will be rigidly protected. A study to determine the current Park distribution and status of these species will be carried out and will guide future protection and management.

C. Wildlife and Fisheries Resources Management

1. Black Bear Management: Yosemite has an estimated population of 220 and 350 black bears (*Ursus americanus californiensis*). Although there are no reliable reports of the pristine population status in Yosemite Valley, the early literature indicates that a notable increase in opportunities to see bears occurred shortly after the area received protective status. According to Parker (1950), "When white man first visited Yosemite, few bears were encountered, unless deliberately hunted..."

The first Park census estimate of 125 bears was made in 1920 by Grinnell and Storer (1924). In the higher country around Yosemite Valley, black bears were virtually unknown above 9,000 feet elevation (Grinnell, Dixon, and Linsdale, 1937). Today, black bears are often recorded above 9,000 feet and occasionally above 10,000 feet elevation. This increase in population numbers and distribution and alterations of natural wild habits is attributed to the former practice of dumping garbage in open pits and the former inadequate solid waste collection program. Though now greatly restricted, access to camper-supplied food stuff continues to attract bears and leads to their learning to raid food sources in camps and automobiles. Property damage and personal injuries are occurring with such frequencies that some bears must be destroyed and many relocated each year (Figure 6).

Management objectives are:

a. To restore and maintain the natural integrity, distribution, abundance, and behavior of the endemic black bear population.

figure 6
Culvert - type bear trap

b. To provide for the safety of Park visitors by planning the development and use of the Park so as to prevent conflicts and unpleasant or dangerous incidents with bears.

c. To provide opportunities for visitors to understand, observe, and appreciate the black bear in its natural habitat with a minimum of interference by humans.

To achieve these management objectives, a program consisting of five basic elements designed to prevent the causes of man-bear conflicts will be implemented. The five program elements are: (1) public information and education; (2) removal of artificial food sources; (3) enforcement of regulations regarding feeding of wild animals and proper food storage; (4) control of problem bears; (5) continuation of a research program on the black bear population dynamics and ecology and monitoring of bear-human relationships.

2. Deer Management: The primary objective of Yosemite's deer management program is to maintain and/or restore with the least form of artificiality, a mule deer (*Odocoileus hemionus*) population and range which is representative of pristine conditions. Evolved policies for natural areas restrict management to protecting against, removing, or compensating for human influences that cause departures from natural conditions (Cole, 1971). Often, however, past management activities, both within and external to the Park, have caused departures from natural conditions, which have resulted in unnatural deer population fluctuations. Some such activities might be longterm suppression of all wildland fire, effective here since 1910, and possibly herd manipulation by regular and special hunts outside the Park and direct reductions within.

Prior to the 1924 foot and mouth epizootic in Tuolumne County, deer numbers in Yosemite were established at 18,000 to 20,000 animals. Deer reduction teams, in an effort to curb the epizootic, removed 22,214 animals within a 1,000-square-mile area in Tuolumne County (Dixon, 1934). This reduction included deer which were removed from the northern portion of the Park in the Tuolumne Meadows area (Figure 7).

A population of 6,000 to 8,000 deer was reported in the Yosemite area from the mid-1930's through the 1950's (NPS Files, Yosemite National Park). Deer control by means of live-trapping and limited direct reduction, was exercised during this period to stabilize populations with their respective ranges. Routine range studies during the early 1960's, by the U.S. Forest Service, California Department

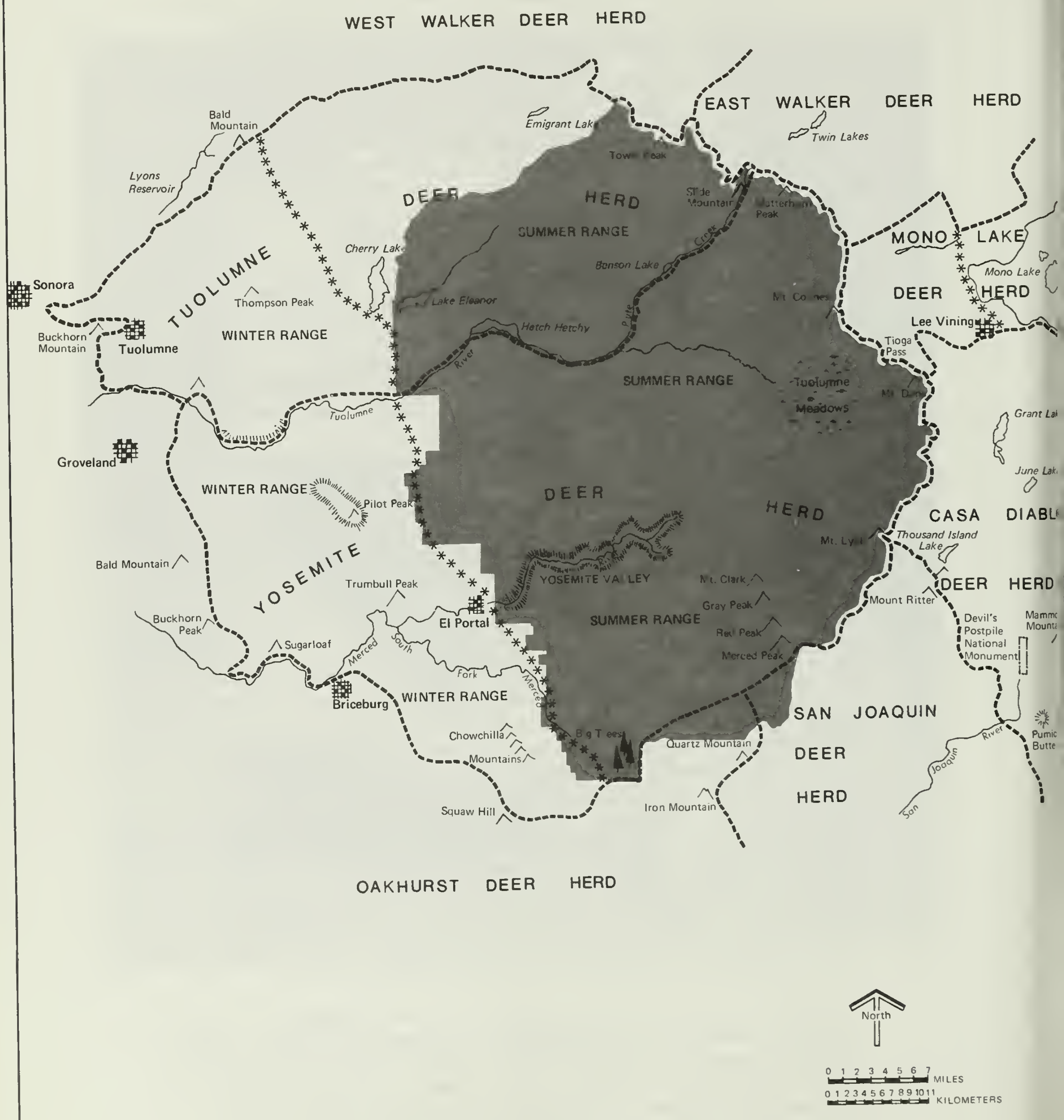

figure 7

DEER HERD UNITS AND SEASONAL RANGES

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of Fish and Game, Bureau of Land Management, and National Park Service, demonstrated an apparent imbalance between deer numbers and range capacities, which indicated serious deterioriation of summer and winter ranges. As a corrective measure, and to remain consistent with Service policies regarding the control of ungulate species, the Park Service proposed a special post-season hunt to be held adjacent to the Park boundaries. When the California Fish and Game Commission refused to issue the number of permits the Service considered necessary, Park reduction teams removed a total of 908 animals within the Park in the fall and spring of 1965 and 1966 respectively. Later, a total of 2,465 deer were harvested by sportsmen outside the Park by means of special post-season hunts in the years 1965-1969 (NPS Files, Yosemite National Park). No special hunts or in-Park reductions have been held since that time.

Currently, ranges show considerable improvement, but deer numbers have recently increased from low to moderate. At present, the Yosemite deer herd is estimated at or near 9,000 animals. Past special hunts and in-Park reductions met with severe political and public criticism. Future management actions regarding any need for direct control will be based on sound biological data from comprehensive field surveys.

Programs designed to solve the above listed problems and meet Service objectives in deer management require implementation of the following two projects:

A management project will annually monitor range condition and trend and herd productivity and survival. The other, a research project, will attempt to develop a reliable index to population levels, identify limiting factors, and evaluate herd response to plant succession and the fire management program.

The outgrowth of the two above programs will be the development of a long-range management program to ensure the perpetuation of natural populations and habitats of mule deer, in the face of increasing land use and development outside the Park and changing use patterns within.

3. Bighorn Sheep Management

   a. Status Surveys and Historical Range Evaluations - According to Grinnell and Storer (1924), the California bighorn (*Ovis canadensis californiana*) became extinct in Yosemite after 1914. However, bighorn have been sighted in and near this Park on a number of occasions since then, the last authentic observation having been made in July, 1974. Surveys by Service biologists in 1972, while failing to find any current evidence of bighorn, determined that the Park has an abundance of high quality summer and fall habitat, and that several suitable potential winter ranges are located east of the Park (unpublished Government report, 1972).

More survey work is needed to determine the size of the existing population and the location and condition of the year-round habitat.

b. <u>Restoration Of Bighorn</u> - Remnant populations in and near the Park would provide the best stocks for eventual reestablishment of the species in much of its original habitat here. Before restoration can be undertaken, survey work now in progress is attempting to determine the size of any existing population and the location and condition of the year-round habitat. Restoration efforts will concentrate first on management to increase any remnant population in or near the Park. Such a program would have to involve several agencies, since all suitable winter ranges probably lie east of the Park on National Forest lands.

However, there is a possibility that soon no remnant populations will exist. Should this occur, it would be desirable to reintroduce the bighorn here from another suitable population source. The best such sources are those in the southern Sierra Nevada, which are probably genetically and ecotypically closest to those that currently inhabit Yosemite. If such stocks are available, they would be vastly superior to any others for reintroduction purposes. Consequently, all avenues for securing animals from this population should be exhausted before any other stocks are considered.

A captive population of the same subspecies is being maintained at Lava Beds National Monument for reintroduction purposes. Wild stocks of this form are also probably available in British Columbia. However, due to geographic separation and dissimilar habitat, this form is probably genetically different from the Sierran form and thus much less desirable for reintroduction purposes.

Frequently, efforts to reestablish bighorn fail due to inherent behavioral characteristics of the species. Consultation with one or more recognized authorities on bighorn behavior and a concerted research effort are needed to insure the best chances for success of any such restorative effort. Care should be taken to insure that reintroduction stocks are disease-free and genetically suitable.

4. Threatened And Endangered Vertebrate Program: The American peregrine falcon (Falco peregrinus anatum) and the southern bald eagle (Haliaetus leucocephalus leucocephalus) are the only native species classified as endangered on the Federal list of Threatened And Endangered Wildlife.

The exotic Paiute cutthroat trout (Salmo clarki seleniris) discussed further in this plan, is the only threatened species found within the Park.

However, beside the California bighorn discussed above, there are an additional 20 species whose status here is undetermined (Table 3).

The objective of management is to preserve these species and if depleted, ultimately restore them to their pristine density and distribution in the Park. However, management can do this only for resident species and only if their status and ecological requirements are known. Thus, detailed research of resident forms is needed. Nonresident species will be given maximum protection, but in the long run, their preservation depends upon the protection and management they receive throughout their entire range.

Routine population monitoring must be conducted to provide early warning of status changes, which if undetected and unchecked, could result in the local extinction of a species. Monitoring also provides an invaluable data bank for subsequent investigation.

The gray wolf (Canis lupus) and grizzly bear (Ursus arctos horribilis), two important native mammals, have been extinct in California since 1922 and 1924, respectively. Although Service policy calls for reintroduction of locally extirpated species whenever possible, no such plans are proposed for these two species at this time. This decision is based upon the fact that for each species, the establishment of a viable population requires a year-round habitat of a size far in excess of what this Park can provide. This latter requirement could only be met by use of surrounding lands. However, use levels there of such activities as stock grazing, lumbering, mining, recreational homesites and camping, and hunting would preclude survival of viable populations of either species at this time.

Table 3. Vertebrates of Undetermined Status in Yosemite

Yosemite toad	(*Bufo canorus*)
red-legged frog	(*Rana aurora draytonii*)
Mt. Lyell Salamander	(*Hydromantes platycephalus*)
Pacific pond turtle	(*Clemmys marmorata*)
sharp-tailed snake	(*Contia tenvis*)
American osprey	(*Pandion haliaetus carolinensis*)
Prairie pigeon hawk	(*Falco columbarius richardsonii*)
ring-tailed cat	(*Bassariscus astutus raptor*)
pine marten	(*Martes americana sierrae*)
fisher	(*Martes pennanti pacifica*)
short-tailed weasel	(*Mustela erminea muricus*)
long-tailed weasel	(*Mustela frenata nevadensis*)
Pacific mink	(*Mustela vison aesturina*)
wolverine	(*Gulo luscus luteus*)
river otter	(*Lutra canadensis brevipilosus*)
badger	(*Taxidea taxus*)
red fox	(*Vulpes fulva necator*)
mountain lion	(*Felis concolor californica*)
aplodontia	(*Aplodontia rufa californica*)
pika	(*Ochotona princeps*)
California bighorn	(*Ovis canadensis californiana*)

5. Vector Control: On occasion, rodents transmit diseases or support parasites capable of transmitting certain diseases to man. The most important such vector is the California ground squirrel (Citellus beecheyi), which on occasion, serves as a reservoir for plague (Pasteurella pestis). Fleas are the agents that carry the disease from squirrel to man. Control is required only in and near developed areas when epizootics are present or imminent, or when vector populations are high and in close contact with people (Kartman, 1958).

Other animals, on occasion, harbor diseases transmissible to humans. Rarely a coyote (Canis latrans) or spotted skunk (Spilogale putorius) is found to be rabid. Suspected animals are collected and sent to laboratories for diagnostic determinations. Should epizootic levels of disease be found, actions to lower the vector population to a level below which the epizootic could persist would be carried out in all affected developed areas.

6. Exotic Animal Control:

a. Neither the golden beaver (Castor canadensis subauratus) nor any other subspecies of beaver is native to the Sierra Nevada above the lowest foothills (Grinnel et. al. 1937). However, this subspecies was introduced by the California Department of Fish and Game to Ackerson Meadow and Big Creek, both adjacent to the Park, in 1940 and 1944 respectively. From these sites beaver moved upstream into the Park. Presently, however, they are established only in a limited area of Jack Main Canyon.

To prevent more widespread distribution within the Park, existing populations must be removed and periodic control work carried out to prevent reoccupation by downstream populations.

b. The bullfrog (Rana catesbeiana), though not native to California, has become established in the State between 1914 and 1920. A population of 40-plus adult individuals exist in the Ahwahnee pond and a few other sites in Yosemite Valley. Recent work by T.B. Moyle (1973), indicates that the bullfrog may be responsible for the disappearance of the native red-legged frog (Rana aurora) over much of the State and reduction in the range of the native yellow-legged frog (Rana boylii). Although the red-legged frog has not been reported in Yosemite Valley for many years, Moyle (personal communication, 1973), believes it is highly likely that they were formerly present.

The bullfrog will be removed from the Ahwahnee pond and all other Yosemite Valley sites where it is found by netting, gigging, shooting and pond drainage. All other habitat will be checked for the presence of this exotic species, and wherever present, control action will be carried out. Follow-up surveys with control actions will be undertaken where necessary to ensure permanent removal of this species.

7. Fisheries Management: The primary objective of the fisheries management program is to preserve and/or restore natural conditions and native fauna in aquatic environments. All other functions, including the provision of opportunities for public recreation, shall be performed within the scope of the Service's responsibility to maintain the resource in an unimpaired condition. Contrary to management policy, fish stocking in Yosemite has largely been confined to genetically altered, hatchery strains of the native rainbow trout (*Salmo gairdnerii*) and other species alien to the Park. Of the eleven fish species in the Park, six represent the indigenous fish fauna of the region; and of these, only the rainbow trout and the Sacramento sucker (*Catostomus occidentalis*) were abundant when modern man penetrated the area in the 1850's. Significantly, these two forms were seen only throughout the lower regions of the Tuolumne and the Merced Rivers. Whether fishes were more widely distributed in the Yosemite region during prehistoric times is uncertain, but if so, they were apparently extirpated in waters above 4,000 feet elevation by Pleistocene glaciation. Waterfalls formed during this period of glaciation acted as natural "fish barriers" and maintained high elevation waters in a natural fish-free condition. With the intrusion of technological man into the Yosemite region, an era of exotic fish introduction began (Marnell, 1971).

A management program was initiated in 1972 to achieve the above stated objectives of gradually phasing-out all fish planting over a six-year period. However, objections to this program have resulted in a two year resumption of limited fish stocking. During this period an evaluation of the biological, economic and recreational considerations relevant to an aquatic resources management plan will be accomplished.

In the event that all fish stocking is terminated, a research project is proposed which will study the effects the phaseout has on fish populations and to determine where self-sustaining fish populations are being maintained. This study would also measure the effect of the exotic fishery and angler use on the aquatic and associated environments.

An existing cooperative agreement was executed in 1965 with the California Department of Fish and Game to establish and maintain an exotic population of the "formerly endangered" Paiute cutthroat trout in Delaney Creek. This population was established to serve as a gene pool for further transplants outside the Park until such time as self-sustaining populations could be established elsewhere.

Recent improvement in the status of the Paiute cutthroat trout has resulted in the subspecies being redesignated from endangered to threatened status on the Federal list and its removal from formal state recognition. Federal threatened status removes the requirement for total protection from angling.

The above, coupled with the fact that the Delaney Creek population has not increased as expected and is suffering serious competition with brook trout (*Salvelinus fontinalis*) indicates that preservation of the subspecies would be better achieved by relocating the remaining fish in another drainage. However, management policy precludes relocation of this exotic population in other Park waters.

On the basis of the 1976 Interagency Meeting between the California Department of Fish and Game and the National Park Service, specific proposals were advanced by the State. Included were electro-shocking, capture and relocation of remaining Paiute cutthroat trout from Delaney Creek to suitable waters outside the Park by the summer or fall of 1978. The National Park Service proposed to reopen Delaney Creek to angling sometime after 1978.

D. Abiotic Resources Management

1. Water Resources: Besides the scenic and scientific value of the Park water resources, this plan recognizes the importance of these resources to the local, regional, and State economies.

   a. Snow Survey: The Park is a cooperator through the California Cooperative Snow Surveys headed up by the Department of Water Resources, Resources Agency, State of California. Eight snow courses are surveyed within the Park. Measurements are taken by Park personnel twice each year on all eight courses, and four courses are read four times annually. Measurements include average snow depth and water content.

b. Water Monitoring: Under cooperative agreements with the Park, U.S. Geological Survey (U.S.G.S.) maintains continuous flow gauging stations on all major Park drainages and is conducting qualitative and quantitative water resources studies throughout the Park. Flows out of O'Shaughnessy and Lake Eleanor dams are measured by the City of San Francisco.

The U.S.G.S. is currently conducting special water quality measurements for the Park at three stations on the Merced River in Yosemite Valley and at two other stations further downstream.

Ground water levels are periodically measured by the U.S.G.S., and during the period 1970-1972, that agency carried out low-flow studies at ten stations in Park streams, tributary to the Merced River.

The Park collects water samples for coliform determinations approximately every ten days from all important domestic water sources.

c. Special Stream Studies: Such studies are carried out as required to provide data relevant to relicensing requests by the City of San Francisco under the Raker Act of 1913, for proposed Wild or Scenic River designations or other similar proposals.

E. Research Program

The overall objective of the research program is the accumulation and synthesis of scientific information concerning the ecosystems of the Park that will permit effective management and interpretation and description of Park ecosystems, the evaluation of visitation on the natural resource base, and the ecological evaluation of management programs.

1. Classification and Description of Park Ecosystems: Basic to the management of any natural area is information concerning the ecosystems and their component parts. Much data already exists, although no systematic analyses have been made. Needed are inventories of resources, analyses of processes, and classifications of ecosystems.

a. Resources Basic Inventory: Fundamental inventory information is available for some resources, although it is either out of date or on maps of a variety of scales. Existing inventories must be updated and coded on maps in such a way that it is readily retrievable. Additional studies will have to be initiated to gather inventory information not presently available.

Basic inventories will include vegetation, soil, water, geology, climate, physiography, and fauna.

b. Analysis of Relationships: Once basic inventory information is complete, the ecological processes, which perpetuate the various Park ecosystems, will be investigated. Specific examples include the relationship between vegetation and environmental gradients such as elevation and moisture, the role of fire as a dynamic ecological factor, and interrelationships between the various mammalian species populations.

c. Ecosystem Classification: A result of the research in the above two categories would be a classification and description of Park ecosystems. Classification schemes could be based on dynamic properties, static characteristics or steady states. A classification allows the extrapolation of specific data to extensive area.

2. Evaluation of the Visitor-Resource System: Since parks do not exist in an ecological vacuum, any analyses would be incomplete without considering the impact of human beings. An evaluation of the sociological and ecological characteristics of the visitor-resource system is essential for assessing the impact of human activities.

a. Sociological Characteristics: Various social parameters control behavior in natural environments. Information concerning such parameters, their implementation, and dissemination, would aid development and protection of Park resources.

b. Use Levels: The determination of use levels must consider both psychological and ecological factors. Knowledge concerning the interaction between an individual and the environment forms the basis for such determinations. Research in this field will lead to use levels for the backcountry, as well as for the developed areas.

3. Evaluation of Management Programs: Research efforts will be directed to the ecological evaluation of management programs and toward the development of improved natural resources management techniques and methods.

a. <u>Program Monitoring</u>: As management programs are conducted, it is important that the responses to management actions be monitored. Specific examples include research concerning effectiveness of vegetative restoration, wildlife management, and fire management programs.

b. <u>Development of Management Techniques</u>: Often, unique conditions warrant the development of specific management techniques where gaps in expertise exist because of a lack of knowledge. Research efforts have refined the techniques for prescribed burning and will be directed toward methods for the extensive use of fire. Another area which needs additional technical information is bear management.

F. List of Natural Resource Management Projects - Yosemite National Park

The following is a list of current and proposed resources management projects:

Reference Number	Project Title	Years From Completion
RM-1	Restore Ecosystems Through Prescribed Burning	Continuing.
RM-2	Natural and Conditional Fire Management	Continuing.
RM-3	Wildland Fire Control	Continuing.
RM-4	Giant Sequoia Grove Restoration	Five.
RM-5	Black Oak Woodland Restoration	Continuing.
RM-6	Meadow Restoration by Trail Reconstruction	Ten.
RM-7	Meadow and Grazing Management	Continuing.
RM-8	Exotic Plant Control	Five.
RM-9	Fomes Annosus and Hazard Tree Removal	Continuing.
RM-10	Plant Propagation and Revegetation	Continuing.
RM-11	Vista Clearing	Continuing.
RM-12	Merced River Clearing	Continuing.
RM-13	Forest Pest Control	Continuing.
RM-14	White Pine Blister Rust Detection	Continuing.
RM-15	Black Bear Management-Direct Control	Continuing.
RM-16	Reduce Bear Access to Human Food Sources	Continuing.
RM-17	Deer Herd and Range Monitoring	Continuing.
RM-18	Reintroduction of Bighorn to Yosemite	Ten.
RM-19	Vector Control	Continuing.
RM-20	Exotic Beaver Control	Continuing.

F. List of Natural Resource Management Projects - Yosemite National Park (Continued)

Reference Number	Project Title	Years From Completion
RM-21	Exotic Bullfrog Eradication	Three.
RM-22	Fisheries Management	Indefinite.
RM-23	Paiute Cutthroat Trout Relocation	One.
RM-24	Snow Surveys	Continuing.

G. List of Natural Science Projects - Yosemite National Park

Reference Number	Project Title	Years From Completion
N-1	Flora and Fauna Inventories	19.
N-2	Vegetation Type Map	Nine.
N-3	Mountain Lion Status Survey	Three.
N-4	Red Fox Status Survey	11.
N-5	Wolverine, Fisher, Marten Status Survey	Three.
N-6	Otter, Mink, Weasel Status Survey	Nine.
N-7	Raptor Status Survey	Six.
N-8	Soil Type Map	19.
N-9	Groundwater Survey	Three.
N-10	Climatic Survey	13.
N-11	Environmental Gradient Study	14.
N-12	Meadow Ecology	Three.
N-13	Effects of Natural and Prescribed Fires	Four.
N-14	Effects of a Possible Discontinuation of Fish Stocking	Six.
N-15	Coyote Status Survey	Five.
N-16	Bighorn Sheep Ecology	Seven.
N-17	Deer Population Ecology	Six.
N-18	Mountain Beaver Status Survey	Eight.
N-19	Large Mammal Population Ecology	Eight.
N-20	Black Bear Ecology in Relationship to Man	Seven.
N-21	Endangered Plant Survey	Seven.
N-22	Bobcat and Ringtailed Cat Status Survey	Ten.
N-23	Succession in Restored Sequoia Groves	Ten.

G. List of Natural Science Projects - Yosemite National Park (Continued)

Reference Number	Project Title	Years From Completion
N-24	Succession in Restored Black Oak Woodlands	Ten.
N-25	Response to Meadow Restoration	Eight.
N-26	Exotic Plant Ecology	14.
N-27	Aboriginal Vegetative Conditions	12.
N-28	Refined Fall Burning Prescriptions	Two.
N-29	Sociological Effects of Backcountry Management	One.
N-30	Effects of Pets on Backcountry Environments	15.
N-31	Effects of Livestock	17.
N-32	Resource Information Base	Six.
N-33	Marmot and Pika Status Survey	Ten.
N-34	Grey Fox Status Survey	12.
N-35	Porcupine Status Survey	12.
N-36	Bear Population Dynamics	One.
N-37	Aversive Conditioning of Bears	Two.
N-38	Bighorn Status Survey	Two.
N-39	Backcountry Carrying Capacities	One.
N-40	Ecological Role of Fire	Continuing.

I. DESCRIPTION OF THE ENVIRONMENT

A. General: Yosemite National Park, comprising 760,917 acres, is located in the east central part of California where it is surrounded by National Forest lands and is within four to six hours driving time from two major urban centers (Figures 1 and 8). It lies at elevations of 2,200 to over 13,000 feet on the gentle western slope of the central Sierra Nevada--the average grade being 2 1/2 percent. The climate is Mediterranean with hot, dry summers and cool, moist winters; annual precipitation varies from a normal of 36 inches in Yosemite Valley to approximately 50 inches at Snow Flat, elevation 8,700 feet. Mean temperatures range from 36 to 72 degrees Fahrenheit in Yosemite Valley at 4,000 feet elevation and from 25 to 53 degrees Fahrenheit in Tuolumne Meadows at an elevation of 8,500 feet.

Geologically, the area is comprised of granitic material formed during three intrusions dating from 200 to 85 million years ago. Subsequent uplifting and erosion created two major drainage basins. Glacial action resulted in the final stripping of the metamorphic overlayer, leaving behind polished domes and moraines and shaping the sheer walls and hanging valleys for which the area is famous. Due to the granitic composition, there are no known mineral deposits of major value.

There are more than 50 soil series in the Park, ranging from new, shallow, coarse-textured chiquita soils found at upland sites, to old, well-developed red clay soils reaching depths of 15 feet found at middle and lower elevations. Parent material is primarily granitic bedrock, glacial deposits, and lesser amounts of metamorphic rock. Higher elevation soils are primarily the results of climate and topography, while middle and lower elevation soils are well-differentiated into various soil series depending upon the vegetation occupying the site.

B. Vegetation and Wildlife: The topography and climate of the Park give rise to a large variety of vegetation and wildlife which can be organized into several ecosystems: chaparral, mixed-conifer, giant sequoia, red fir, lodgepole pine-subalpine, and alpine. General characteristics, elevation ranges, and typical members are described in Table 4. Ecosystems are delineated in Figure 9.

Special aspects of some of these ecosystems should be noted. The giant sequoia ecosystem is an historic as well as natural resource. Starting in the 1850's, the unique giant trees of the Mariposa Grove drew large numbers of visitors to the Park area. Interest in the preservation of the giant sequoia played an important role in the enaction of the original Yosemite Grant of 1864. In the surrounding Sierra, the mixed-conifer ecosystem is being disrupted by logging operations; as a result, this association within the Park remains as an important example of its type. The lodgepole pine--subalpine ecosystem receives the greatest amount of back-country visitor use.

figure 8

Natural Resources and Existing Development

Yosemite National Park — U.S. Department of the Interior — National Park Service

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Table 4. Ecosystems in Yosemite National Park.

Chaparral Ecosystem

Limited occurrence within the Park of about 18,272 acres. Elevation 2,000 at western Park boundary to 5,000 feet. Typical members:

canyon live oak	*Quercus chrysolepsis*
digger pine	*Pinus sabiniana*
chamise	*Adenostoma fasiculatum*
buckbrush	*Ceanothus cuneatus*
Mariposa manzanita	*Arctostaphylous mariposa*
mountain mahogany	*Cercocarpus betuloides*
scrub jay	*Aphelocoma coerulescens*
brown towhee	*Pipilo fuscus*
California thrasher	*Toxostoma redivivum*
brush rabbit	*Sylvilagus bachmani*
spotted skunk	*Spilogale gracilis*

Mixed-Conifer Ecosystem

Moderate distribution within the Park of 162,161 acres. Elevation 2,000 to 6,500 feet. Typical members:

ponderosa pine	*Pinus ponderosa*
sugar pine	*Pinus lambertiana*
incense-cedar	*Libocedrus decurrens*
Douglas-fir	*Pseudotsuga menziesii*
white fir	*Abies concolor*
California black oak	*Quercus kelloggii*
bear clover	*Chamaebatia foliolosa*
deer brush	*Ceanothus integerrimus*
California gray squirrel	*Sciurus griseus*
Steller's jay	*Cyanocitta stelleri*
pygmy nuthatch	*Sitta pygmaea*
mountain kingsnake	*Lampropeltis zonata*

Giant Sequoia Ecosystem

giant sequoia	*Sequoiadendron giganteum*
white fir	*Abies concolor*
sugar pine	*Pinus lambertiana*
incense-cedar	*Libocedrus decurrens*
green-leaf manzanita	*Arctostaphylous patula*
mountain white thorn	*Ceanothus cordulatus*
little leaf ceanothus	*Ceanothus parvifolius*

Fauna is similar to surrounding mixed-conifer forests.

Red Fir Ecosystem

Elevation 6,500 to 8,000 feet. Moderate distribution of 173,581 acres within the Park. Pure stands of red fir are common. Typical members:

red fir	Abies magnifica
Jeffrey pine	Pinus jeffreyi
lodgepole pine	Pinus contorta
green-leaf manzanita	Arctostaphylous patula
chinquapin	Castanopsis sempervirens
chickaree	Tamiasciurus douglasi
Allen chipmunk	Eutamias townsendi
goshawk	Accipiter gentilis
green-tailed towhee	Chlorura chlorura

Lodgepole Pine-Subalpine Ecosystem

Elevation 7,000 to 10,000 feet. Extensive distribution of 301,482 acres. Pure stands of lodgepole pine; timber line forests; various meadow communities. Typical members:

western white pine	Pinus monticola
western juniper	Juniperus occidentalis
lodgepole pine	Pinus contorta
white bark pine	Pinus albicaulis
mountain hemlock	Tsuga mertensiana
willow	Salix Eastwoodiae
huckleberry oak	Quercus vaccinifolia
red heather	Phyllodoce breweri
white heather	Cassiope mertensiana
Belding ground squirrel	Citellus beldingi
pine grosbeak	Pinicola enucleator
Clark nutcracker	Nucifraga columbiana

Alpine Ecosystem

Moderate distribution of 105,109 acres. Above tree line from 10,000 feet to the tops of ridges and peaks. Very few species in small meadows, grassy benches, or rocky areas. Typical members:

alpine willow	Salix petrophila
short hair sedge	Carex exserta
short hair grass	Calamagrostis breweri
rosy finch	Leucosticte tephrocotis
Mt. Lyell salamander	Hydromantes platycephalus
Yosemite toad	Bufo canorus
yellow-legged frog	Rana muscosa

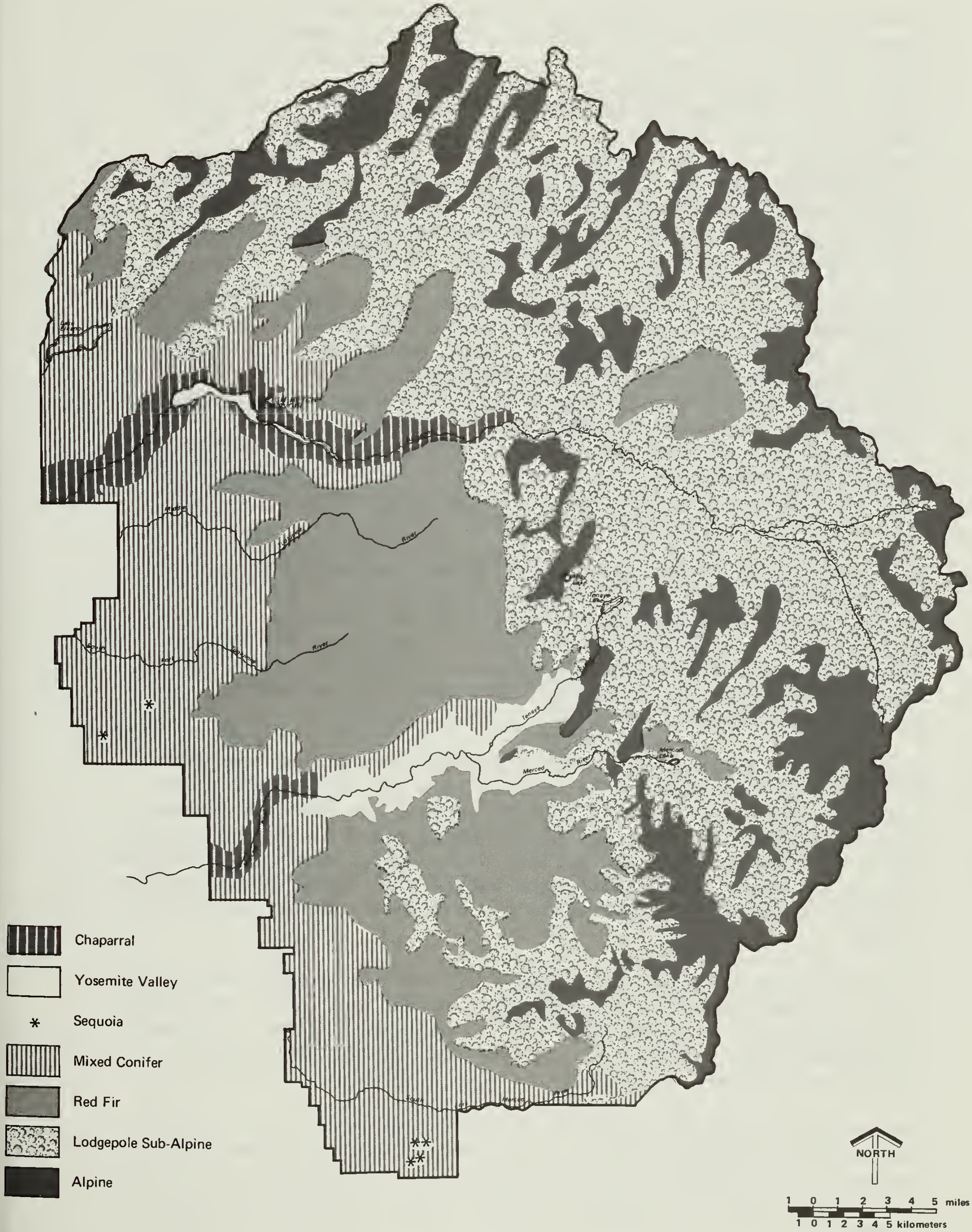


figure 9

Ecological Management Units

Yosemite's wildlife, in addition to the typical members listed for the ecosystems in Table 4, includes a variety of common species, many of which are found in multiple zones. These include the mule deer, which migrates between National Forest lands and its summer range within the Park, the black bear, the coyote, 32 species of rodents, and over 220 species of birds. Of 11 species of fish found within the Park, six are native, but only two, the rainbow trout and the Sacramento sucker, were abundant in pristine time. Original populations extended only into the lower reaches of the Park's watershed; present distributions, particularly above 4,000 feet elevation, represent the effects of stocking.

The influence of modern man has made important changes in Yosemite's ecosystems since his entry into the Park area. These alterations include: unnatural accumulation of fuels; proliferation of dense, woody understory in several forest communities including the giant sequoia and mixed-conifer; thickening and decadence of chaparral brush fields; reduction in the numbers and size of meadows; a lack of regeneration of giant sequoia and black oak forests; extinction of two large carnivores, the grizzly bear and the gray wolf in the Park and the State; and unnatural fluctuations in wildlife populations, distributions, and densities.

Associated human activities thought to have caused these changes are: suppression of naturally occurring fires; introduction of exotic plants, animals, and diseases; extensive grazing of stock; proliferation of trails; alterations of river channels; intense hunting of predators; and introduction of structures and unnatural foods. While some of these activities have been curtailed, some continue into the present.

C. Socioeconomic Environment: Areas of most concentrated development of visitor and administrative facilities occur near or in prime scenic attractions: Yosemite Valley, Wawona, and Tuolumne Meadows. Less concentrated development occurs along roads or at recreational sites: Hodgdon Meadows, Crane Flat, White Wolf, Chinquapin, Glacier Point, and Badger Pass. Scattered backcountry development includes the High Sierra Camps, Ostrander Lake ski hut, and various wooden cabins.

In addition, significant development is found on private inholdings, including dams and reservoirs at Hetch Hetchy and Lake Eleanor, and various structures at Wawona, Foresta, and Aspen Valley. A summary of National Park Service and concessioner camping and lodging facilities is shown on Table 5.

The Park is surrounded by National Forest lands of similar environment and use characteristics; thus modifications of use characteristics or ecosystems within the Park may result in alterations in the forests. This may be particularly true where uses or use levels change markedly on an adjacent unit of land. In addition, due to

Table 5. Yosemite Camping and Lodging Facilities

	Developed Campground Units	Existing Lodging Units
Yosemite Valley	886	1,528
Wawona	100	63
Bridalveil Creek	110	-----
Foresta	1	-----
Crane Flat	164	-----
Hodgdon Meadows	110	-----
Hetch Hetchy	0	-----
White Wolf	86	13
Tamarack Flat	50	-----
Smokey Jack	25	-----
Yosemite Creek	30	-----
Porcupine Flat	50	-----
Tenaya Lake Walk-in	50	-----
Tuolumne Meadows	600	66
Tuolumne Walk-in	50	-----
May Lake	------	8
Glen Aulin	------	8
Vogelsang	------	12
Merced Lake	------	19
Sunrise	------	9
TOTALS	2,312	1,726

the migratory nature of some vertebrates and insects, direct cooperation between the National Park Service, U.S. Forest Service, Bureau of Land Management, Fish and Wildlife Service, Bureau of Outdoor Recreation, and the California Department of Fish and Game is necessary.

A current cooperative project involves the National Park Service with several of the above-listed Federal agencies in the Tuolumne Wild and Scenic River Study. Results of this study will affect usage of the Tuolumne watershed both inside and outside the Park.

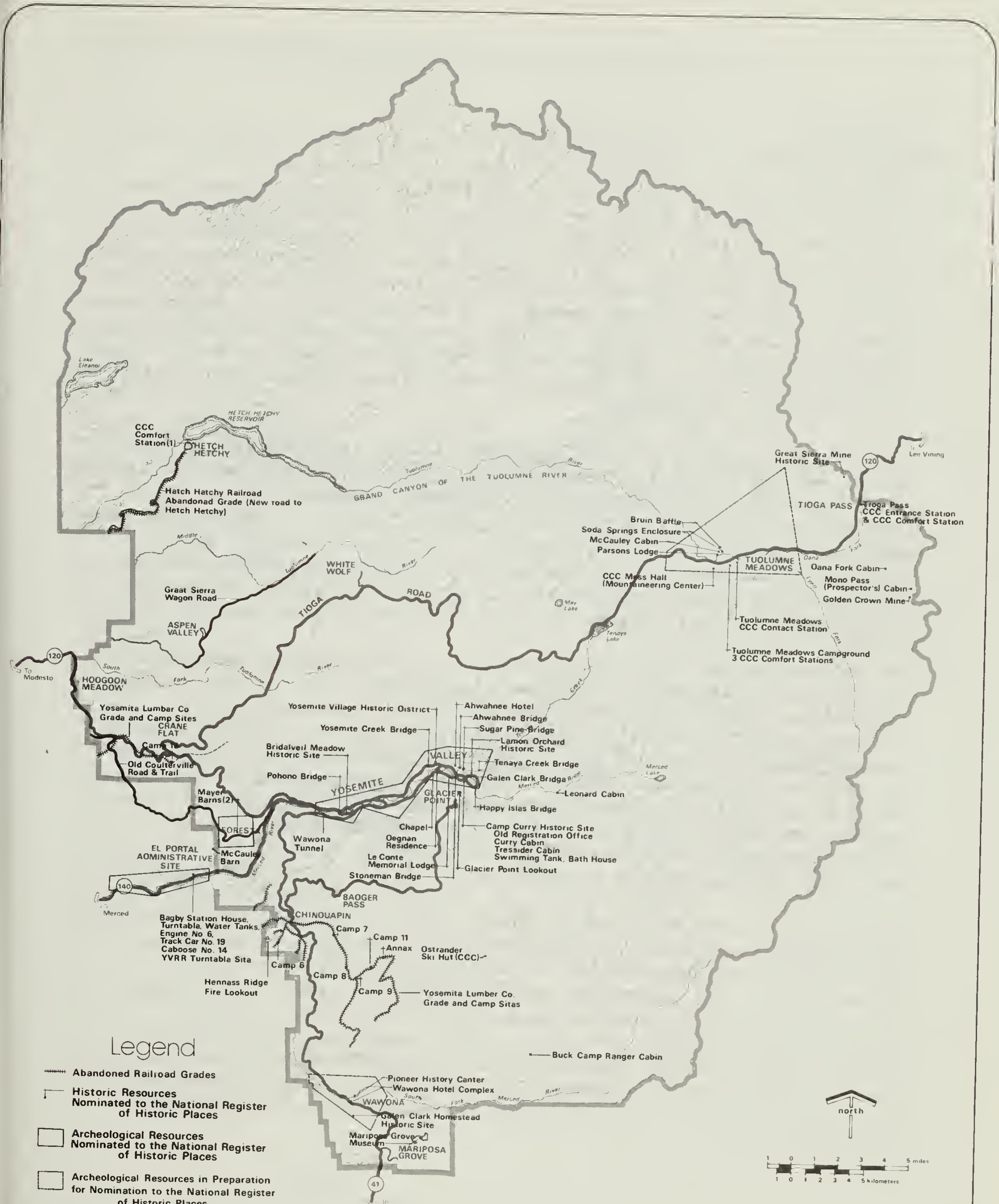
Since communities on access roads to the Park are to some extent dependent on revenue derived from Park visitors, alterations in use amounts or distributions within the Park may affect these communities (Figure 1).

The Tioga Pass road which connects the west and east sides of the Sierra Nevada through the Park also influences the economic environment of the communities located on connecting access roads Since the road is closed by snow during the winter, the opening of the road in spring helps to determine the length of the visitor season, particularly on the east side where there is no winter access to visitor facilities in the Park.

D. Cultural Resources: Archaeological resources are the results of Indian inhabitation of the Park area, possibly dating from as early as 533 ± 100 B.C. Principle developed areas which were used by the Indians include Yosemite Valley, El Portal, Wawona, Foresta, Big Meadow, and Tuolumne Meadows; in addition, some sites have been identified in the backcountry.

In compliance with Executive Order 11593, Protection and Enhancement of the Cultural Environment, May 13, 1971, an archaeological survey of areas being considered for development has been completed. Other areas of potential archaeological resources have been determined to be potentially eligible for nomination to the National Register of Historic Places and will be managed accordingly. These districts are located at Yosemite Valley, Tuolumne Meadows, Wawona, El Portal, and Foresta/Big Meadow (Figure 10).

The history of white man in Yosemite begins in 1833, with the passage of the Joseph Walker party through what is now the north part of the Park. The first entry into Yosemite Valley occurred in 1851. Thereafter, increasing visitation and exploitation led to the original Yosemite Grant of 1864, giving Yosemite Valley and the Mariposa Grove of giant sequoias to the State of California as a public trust, and pioneering that social concept of land use. The surrounding lands became a National Park in 1890, under administration of the U.S. Army. In 1905, California ceded the original land grants back to the Federal Government to become part of the Park. Upon its creation in 1916, the National Park Service took over responsibility for the Park.



Nominations to the National Register
Historic and Archeological

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Historical resources include various structures from Yosemite's pioneer days, some of which were removed to the Pioneer History Center at Wawona for preservation and interpretation. In compliance with Executive Order 11593 and the National Historic Preservation Act of 1966, a survey of historic resources in Yosemite National Park has been completed. The sites and structures in Table 6 are listed or have been nominated for listing in the National Register of Historic Places and will be managed accordingly. Yosemite Valley has also been designated a California Historical Landmark, No. 790, in recognition of the June 30, 1864, United States grant of Yosemite Valley and the Mariposa Grove of Big Trees to the State of California.

E. The Probable Future of the Environment Without the Proposal: Middle and low elevation ecosystems will continue to accumulate dense vegetation increasing the possibility of uncontrollable wildfire and decreasing available forage for wildlife, while communities within these ecosystems such as the giant sequoia or black oak woodland will continue to be replaced by advancing succession. Some introduced plants will continue to extend their range, replacing native species.

Black bears will continue to utilize human food supplies resulting in abnormally high population levels and a high rate of human-bear encounters. Population levels and ecological requirements for various species will not be monitored; thus, the survival of some species may be threatened within the Park without early enough warning for preventive measures. Formerly occurring wildlife species will not be reintroduced, while exotic species will not be removed and may proliferate to the detriment of native species. Fish populations will continue to be maintained by stocking in waters where they are not native.

The safety of Park visitors and their property will be reduced due to hazardous trees, possible drownings caused by river snags, bear encounters, and possible infection from vector carried diseases. Distant scenes may be less hidden by smoke, but forest areas will be more closed making cross-country travel difficult and obscuring scenery. Some historically important views will remain hidden from today's visitor. The number of lakes containing fish will not be reduced, providing more diversity for fishermen. Some archaeological sites will not be located due to dense brush and ground cover.

Table 6. Cultural Resources Listed in or Nominated to The National Register of Historic Places.

Yosemite Valley	Nominated to National Register	Listed on National Register
Yosemite Village Historic District	X	
Yosemite Valley Chapel		X
Le Conte Memorial Lodge		X
Degnan Residence & Bakery		X
Ahwahnee Hotel		X
Lamon Orchard Historic Site	X	
Bridalveil Meadow Historic Site	X	
Camp Curry Historic Site	X	
Mother Curry's Bungalow	X	
Foster Curry Cabin	X	
Swimming Tank Bathhouse	X	
Yosemite Valley Bridges	X	
Yosemite Valley Arch. Dist.	X	
Tuolumne Meadows		
Parsons Memorial Lodge	X	
Soda Springs Cabin	X	
Tuolumne Meadows Archeological Dist.	X	
McCauley Cabin		X
Wawona		
Army Cabin (PHC)	X	
Hodgdon Homestead Cabin (PHC)	X	
Wawona Covered Bridge (PHC)	X	
Yosemite Transportation Co. (PHC)	X	
Chris Jorgenson Studio (PHC)	X	
Anderson Cabin (PHC)	X	
Wawona Hotel and Pavilion		X
Wawona Archeological District	X	
Mariposa Grove Museum	X	
Galen Clark Homestead Hist. Site	X	
El Portal		
Bagby Station, etc.	X	
HHRR Engine No. 6	X	
HHRR Track Bus No. 19	X	
El Portal Archeological District	X	
Park General		
Glacier Point Trailside Museum	X	
Golden Crown Mine	X	
Great Sierra Mine	X	
Great Sierra Wagon Road	X	
Old Coulterville Road and Trail	X	
McCauley Barn/Meyer Barns	X	

III. THE ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

A. Impacts Of Vegetative Resources Management

1. Vegetation: Management alternatives will be responsible for significant impacts on vegetation. Where fires are routinely suppressed, the impacts are proportional to the degree of natural fire occurrence. In Yosemite, natural fires occur periodically in all ecosystems except the alpine, where they are infrequent. The chaparral, giant sequoia, and mixed-conifer ecosystems historically show signs of frequent fires, e.g., once every seven years in ponderosa pine forests (Weaver, 1951). Detrimental impacts of fire suppression in forests include a denser canopy; dense, stagnant thickets in the understory; large accumulations of fuels on the floor; and species changes toward shade-tolerant trees with declines in shrubs and herbs. Impacts on chaparral brush fields are shifts to late successional species, heavy accumulation of dead standing fuel, decadence, and thickening of shrubs. Reproducing the original vegetative mosaic is virtually impossible without the presence of fire. However, in many areas which are already densely covered and contain unnaturally large fuel accumulations and fuel ladders, fire suppression is necessary during certain periods of the year to prevent abnormal successional setback and possible unnatural soil loss.

   Prescribed fires offer control of timing, intensity, and extent of impact through proper choice of prescription. Prescriptions devised by Schimke and Green (1970) and refined by van Wagtendonk (1972, 1974) predict potential fuel reductions, vegetation impacts, and safe burning limits. Where fire intensities are low, effects are limited principally to the understory, but under dry conditions, the overstory will also be affected on those sites where fuel loads are high and vertical distribution is continuous. In all communities, species shifts will occur with fire adapted species such as giant sequoias and ponderosa pine being favored. Seedling germination will be improved for many species including the giant sequoia. In forest communities with intense fires some of the canopy will be removed, improving growth of forbs and shrubs but consuming some of the seed. If most of the seed is depleted, the shrubs must complete their life cycle before the occurrence of another fire, or the species may be eliminated from the area (Biswell, 1967). Such fires may act to naturally control the extent and intensities of parasitic organisms within the forest including, for example, root rot fungus (*Fomes annosus*) (Parmeter and Uhrenholdt, 1975). In meadows, herbaceous plants are favored by the presence of fire, and diversity usually increases with the presence of more wildflowers and forbs. Among woody plants, sprouting species such as the black oak are favored over non-sprouting forms. In general, fire recycles nutrients and increases both seed production and nutrient content in shrubs and forbs.

Use of prescribed fires in meadows in Yosemite Valley will both return nutrients to the soil increasing plant growth and kill small trees invading such areas. Where trees are killed by fire or removed by cutting, decreased evapotranspiration will occur, and a higher water table will result. Since meadows are a seral stage dependent on wet conditions, these factors will tend to preserve their size. Early photographs of Yosemite show that meadows used to be much larger than they are today because of technological man's influence (Gibbens and Heady, 1964). The preservation and restoration of these meadows is a beneficial impact (Figures 11a and b).

Impacts of natural fires are similar to those of prescribed fires. Since there is less direct control, natural fire management units are chosen in areas of low-fuel accumulation and with natural fire breaks for boundaries, thus limiting the intensity and extent of detrimental impacts. To further limit the possibility of escape, prescribed burning can be used to create buffer zones at unit boundaries. The cycle which occurs in the presence of natural fires results in stability of fuel levels and energy, biomass, and nutrient transfer relationships instead of the long-term instability of the so-called "climatic climax" with its heavy accumulation of fuels and corresponding high probability of uncontrollable fire. Natural fires also recreate the vegetative mosaic; areas contain sections of fire adapted species as well as sections which, because of greater fuel moisture or different fuel type, are burned less frequently and contain non-fire-adapted species (Kilgore, 1971b; Agee, 1973).

Prescribed burning and Natural and Conditional Fire Management could result in damage or destruction of plants proposed for Threatened or Endangered Status. Losses attributable to natural fire would be the result of a natural process and thus acceptable. However, while individual plant losses are possible, the loss of a species from this cause is extremely unlikely since each of these species have evolved with the fire influence operating. On the other hand loss from prescribed burning would be unnatural and undesirable. Such damage is avoidable due to conditions described below.

A. Meadow during burn

B. Same Meadow several weeks after the burn

figure 11 A Yosemite meadow viewed during and after a prescription burn.

All known locations of plants proposed for Threatened or Endangered Status are mapped. These maps will be used by the Prescribed Fire Committee to determine whether any proposed burn entails any risk to species in question and what mitigating measures would be needed for their protection.

Of the 14 proposed species five inhabit habitats above timberline, bare rocky domes, talus gravels or rocky crevices. Due to the scarcity of vegetation in such habitats none of these species would be affected by prescribed burning. One species, *Allium yosemitense* is limited to one small location at the top of Bridalveil Falls. All prescribed burning will be excluded from this site unless studies reveal that this plant is fire adapted. *Carex whitneyi* is found in restricted sites at Happy Isles, Iron Spring, Mono Meadow and Ostrander Rock. No prescribed burning will be permitted at these sites unless it can be clearly shown that this species is fire adapted. *Trifolium bolanderi* is reported from moist sites in Peregoy, Westfall and Bridalveil Meadows while *Drosera rotundifolia* is found in boggy sites in Turner Meadow and Swamp Lake. These sites will be protected during any prescribed burning activities.

The remaining six proposed species have not been recorded here and are listed as possibly occurring in the Park. Two of the latter inhabit sloping grounds in foothill woodlands and rocky slopes. Due to the discontinuous arrangement of fuels in such sites, the chances of being burned by a prescribed fire are quite small. Three more of the six remaining species are confined to foothill habitats, which are very restricted in this Park. Another species is confined to the mixed-conifer community. Due to the natural occurrence of fire in the foothill and mixed-conifer communities, it is likely that all six species are fire adapted or utilize habitats protected from fire. If any of these species would be found in a burn unit they would be protected or the burn suppressed.

Annosus root rot (*Fomes annosus*) is a native fungus which attacks the root system of conifers. Infection may be through stumps, wounds, or, where trees are dense, through interconnecting root systems. It is possible that insects may also carry the fungus and that spores may attack live trees, particularly if suppressed. Due to the spread of infection from one root system to another, radially expanding infection centers form. In these centers most or all coniferous trees become infected over a period of time. Such trees, although still living, present a hazard to safety in developed areas as the weakened root system permits the trees to fall without warning (Figure 12). Where trees are dense, removal of suppressed trees and uprooting the stumps where possible, may help preserve vigorous trees by removing infection pathways. The coniferous trees removed in this process would probably have succumbed to the disease if not removed. To prevent the

figure 12

Hazard Tree Damage

accidental infection of nearby trees during hazard tree or understory removal, treatment of new stumps with borax within one hour has been recommended. The use of borax in this way will not create significant side effects. (J.R. Parmeter, Jr., personal communication).

Impacts on vegetation by the removal of annosus infected trees will be limited to developed areas primarily in Yosemite Valley. Where most coniferous trees are removed leaving perhaps only a few vigorous mature trees, the density of conifers may be closer to that found by the first non-Indians entering Yosemite. Revegetation with apparently non-susceptible native hardwoods from Park stock will produce a tree community much closer to that which existed in 1851. Thus, in terms of restoration of pristine conditions, such impacts may be considered beneficial.

Removal of trees which have become hazardous from other causes including heart rot, insect attack (except for Lodgepole needleminer), or mechanical injury, affects a limited number of trees in developed areas of the Park only. Since such trees would fall soon if not removed, there is little vegetative impact except for some loss of nutrients where trees are removed from the Park. Where hazardous trees are infected with bark beetles, they are sprayed with an approved chemical. Due to the limited number of trees so treated and the direct application, little direct effect is created on other vegetation. However, since trees adjacent to developed areas also harbor bark beetles, rates of infestation may not be significantly reduced.

Chemical treatment of lodgepole pine if and when under attack by lethal infestations of the lodgepole needleminer would adequately protect the trees. Since this action would be entirely confined to developed areas, primarily those in Tuolumne Meadows and Tenaya Lake, the scope would be small. Relatively little other vegetation would be affected.

Revegetation of developed areas with native plants and trees, collected within the Park from local genetic strains, will have beneficial impacts on vegetation. Due to soil compaction, trampling, wood collection, etc., natural revegetation from seed or resprouting often fails to occur in such areas. Thus, for example, trees removed for hazard reduction may not be replaced by natural reproduction resulting in fewer trees. However, where species more resistant to the degradation found in developed areas are used for revegetation, some local shifts from natural vegetative associations may result.

Impacts of environmental restoration and vista clearing through the removal of understory trees are limited to small areas containing special resources such as the giant sequoia groves, black oak woodlands, historic and scenic views, and several sites that shade road locations that are persistently icy and dangerous during winter. In general, the reproduction and growth of shade-intolerant species such as the black oak or giant sequoia will be favored by this removal due to the increased sunlight reaching the forest floor. The reduction of trees will reduce evapotranspiration and increase available moisture; since the giant sequoia has relatively shallow roots, its vigor should be increased by this process. Fomes annosus has been found in the root systems of giant sequoias (Piirto, Parmeter, and Cobb, 1974); since suppression appears to increase susceptibility to this fungus, the increase in vigor may help reduce infection in the sequoias. Similarly, the remaining conifers may also be less susceptible to infection. Understory removal will eliminate fuel ladders permitting the use of prescribed fires; such fires favor the reproduction of both the black oak and giant sequoia. All of these effects will tend to recreate vegetative conditions such as open forests and meadows which existed in pristine times, a beneficial impact.

Where grazing of stock is intense, it can create significant impacts upon meadows. Density and total volume of herbage are reduced; species shifts from perennials to annuals occur as do changes in distribution and relative numbers of various species since grazing is preferential. Where trampling and over-grazing compacts soil and creates openings in the ground cover, a variety of impacts occur: erosion and water table reduction cause species to shift, exotics are more likely to supplant native species, and woody vegetation tends to invade. Early season grazing can deplete root reserves and decrease the vigor of meadow vegetation. Where pelletized or other feed is used to reduce pressure on the meadows, exotics may be introduced from seed contained in the feed itself. These are adverse impacts.

Risk of damage from grazing to proposed Threatened or Endangered plants is minimal. Five species are confined to sites where grazing by domestic livestock is virtually unknown. These are: several sites above timberline, bare rocky domes, rocky crevices and talus gravels. In this Park (Allium yosemitense) is known to inhabit only one site above Bridalveil Falls. No grazing occurs there. Six more plants possibly occur within the Park but their existence here has never been confirmed. Five of these are restricted to foothill habitats, where all domestic stock grazing in this Park has been discontinued. One species (Lewisia congdonii) inhabits mixed-conifer forests of Fresno and Mariposa Counties but has never been recorded in the Park. Grazing, except by native wildlife, is light in the mixed-conifer community.

Three species inhabit meadows. Of these three, (Trifolium bolanderi) inhabits meadows where grazing is no longer permitted. The sedge (Carex whitneyi) is proposed for threatened status only in Yosemite Valley. Grazing is no longer permitted there. Outside the Valley this plant is recorded on 11 sites and three of these are in locations where all grazing has been discontinued. (Drosera rotundifolia) is recorded in Yosemite only in boggy portions of Turner Meadow and Swamp Lake. Swamp Lake is not grazed and Turner Meadow is seldom grazed by domestic livestock. The fact that this plant was preserved even though Turner Meadow was moderately grazed annually up to September 15, 1974 coupled with the California Native Plant Society recommendation that this plant no longer be listed as rare, threatened or endangered, indicates that current management and use will afford ample protection.

Monitoring of available grazing resources, enforcement of regulations, selective boundary fencing and realignment of drift fencing will better regulate and reduce grazing impacts on meadow vegetation. Removal of man-induced lodgepole pine invasions will restore former meadow areas. All of the latter are beneficial impacts.

Preservation of the natural vegetative composition of Park ecosystems will be enhanced by the removal of approximately 300 exotic trees and some exotic shrubs and herbaceous species.

The removal of 20 to 30 fallen trees or those likely to fall into the Merced River has no appreciable direct affect on the vegetative resource of Yosemite Valley. However, in that this action tends to keep the river from breaking through its banks and establishing new channels it has indirect effects on vegetation and results in a departure from the natural regulation of this ecosystem. Thus this action constitutes a detrimental impact.

Habitat protection of threatened and endangered plants will serve to preserve these species and other vegetation.

2. Wildlife: The effects of vegetative management alternatives on wildlife are keyed to their effects on wildlife habitat. Forbs, shrubs, and mast producing species are favored by prescribed and natural fires while understory trees or dense over-grown shrubs are encouraged by fire suppression. Since the distribution of plant growth potential nearer the ground allows energy to be more readily available to browsing and foraging animals, deer and bear profit from the presence of fires (Lyon and Pengelly, 1970). Also, fires in general tend to result in additional crude protein and phosphoric acid content in preferred browse species (Lawrence and Biswell, 1972). In the absence of fire, the vegetation tends to

become uniform over a given area, while the effects of fire are to create a mosaic of different vegetative types. The "edge effect" thus created provides increased ecological diversity with habitat for a greater variety of animal species. Thus, in a mixed-conifer forest, avifaunal biomass does not change, but species shifts occur; ground nesters and feeders generally decrease, but species living on the edges of habitats increase as do predatory birds and mammals (Kilgore, 1971a).

Where areas are already densely covered and contain large fuel accumulations or fuel ladders, fire suppression during the warmer parts of the year may be the only way to protect the wildlife existing there. Where fires are suppressed by the use of chemicals such as Phos-check (diammonium phosphate), local fish populations may be affected adversely under some circumstances (Hakala, 1971). Effects of fire on animal habitat can be controlled by proper choice of prescription or by careful selection of natural fire management units with regard to fuel load and climatic conditions.

Native animals have evolved with fire and they have developed mechanisms to cope with it. Birds and the larger, more mobile mammals easily avoid most fire by temporarily moving out of its path. Small, ground-dwelling species retreat to burrows and crevices in rocks to avoid it. Tree squirrels usually evade fires by simply climbing high above it in trees. Fires burning at the mild intensities characteristic of prescribed and natural management fires are especially easy for wildlife to avoid. Often birds and squirrels can be observed carrying on normal activities in trees while fires burn underneath. Deer seem to be attracted to mild fires and frequently forage around the fringes of such fires for days. Also deer or their tracks are often seen in areas burned as recently as 24 hours before. Usually within six to 18 hours after the passage of prescribed or natural fire, most animal activity appears almost normal. It is not uncommon then to hear a number of birds calling as they forage in the trees. Fresh earth is also visible at the mouth of a number of gopher burrows, and lizards can be seen sunning themselves on recently burned logs and numerous insects are flying and crawling on tree trunks, burned logs and the ground. Contrary to public belief, evidence of animals killed by even large, wildland fires is extremely rare.

Removal of trees for the purposes of environmental restoration, hazardous tree reduction, and vista clearing will create habitat changes for wildlife in limited areas. The reduced cover in areas where large-scale understory removal is practiced will result in increases in browse and forage in the form of forbs, shrubs, and mast producing species. These changes will aid squirrel, deer and bear populations. In campgrounds where all dead trees are felled, habitat for tree squirrels, woodpeckers and other species that require snags for nest sites or shelter is reduced. The spraying of felled hazardous trees infested with bark beetles has an insignificant effect of removing that particular insect population.

Other than striking mortality on chicken eggs during early incubation, use of Malathion and diesel in lodgepole needle-miner control was tentatively determined to have little or no adverse effect on birds and mammals (1963 Needleminer Project Report). Experience elsewhere reveals little or no adverse effect on trout but significant short-term losses of many species of aquatic insects.

Plant propagation in denuded developed areas and construction sites will increase density and result in small scale benefits to wildlife. Removal of exotic plants such as apple, pear and other fruit-bearing trees will constitute a minor loss in food for bears, raccoons and other fruit-eating wildlife. River clearing activities would only affect wildlife as these actions result in departures from the natural regulation of the ecosystem.

The effects of intense stock grazing on animal populations are to decrease cover and food supplies for some small animals with possibly increased predation. Possible extensions of range for California ground squirrels into middle elevation meadows may occur where grazing results in lowered grass heights preferred by these animals. Such an increased number of squirrels may hasten erosion of meadows due to the associated added use of vegetation and tunnel building. Setting of proper grazing limits as determined by proposed studies and use of restorative measures will reduce such impacts below significant levels. Relocation or improved design for trails in meadows will benefit wildlife to the extent these actions protect and/or maintain overall meadow communities.

3. Air Quality: Impacts on air quality will be the result of fire management alternatives. Fire suppression, if effective, will keep particulate levels low, and other pollutants would be the result of emanations from living plants and decomposition processes excluding fire. However, due to the heavy fuel load in suppression zones, inability to suppress a wildfire may result in large amounts of pollutants being released without regard to time or place.

The amount of pollutants created by prescribed fires depends upon various factors many of which may be controlled. The total amount of particulate matter is increased according to the amount of fuel consumed; also, smoldering fires produce higher amounts of particulates (Darley, et al., 1973). Fuel type also has an effect, as some fuels such as incense-cedar produce three to four times as much particulate matter as white fir or ponderosa and sugar pines. Backing fires, because of their slower burning, combust fuels more completely, resulting in less particulate matter in the flaming stage. They also generate less convective energy to distribute particles in the air. Headfires, in general, produce around 35 percent more particulates than backfires. Where fuel moistures are low, pollutants are reduced. Some flame retardants such as diammonium phosphate increase particulate emmissions by a factor of 1.5 to 15, while others such as ammonium sulfate only slightly less effective at reducing flames, cause little or no particulate increase. Hydrocarbons are produced, but usually in very low concentrations; methane in concentrations of 13 to 14 ppm, and smaller amounts of ethene, ethylene, propylene, ethane, acetylene, propane, and propene, have been found (Darley, et al. 1973).

Likewise, impacts of particulates on air quality can often be controlled in prescribed fires. Visible light is scattered most effectively by a particle size of .6 microns. Since average particle size tends to be .1 micron, and smaller particles are possible with higher intensity fires, a blue translucent smoke can be created. Also, if unstable weather is chosen, dispersal can be achieved; sometimes removal of particulates by rain may occur. Daytime burning can take advantage of atmospheric instability from convective heating, and daytime fires smolder less. Burning can often be done such that smoke drift will avoid heavily used or scenic areas as well as those where potential pollution problems already exist.

Factors affecting the impact of prescribed fires on air quality also affect those of natural fires, but are subject to less direct control. Natural fire management units are chosen with light fuel loads and natural fire breaks--conditions usually occurring in the higher elevation ecosystems. Light fuel loads generally mean low intensities and reduced particulates. Fuel types are not subject to direct control, but the firs and pines comprising most of the tree population are probably similar to their lower elevation relatives in producing less particulates. Since most natural fires burn in middle or late summer, fuel moistures are generally low, decreasing particulate production. If these fires are chemically suppressed, an appropriate flame retardant can be used to reduce the amount of particulate matter. The impacts of particulate production may be greater for natural fires since smoldering at night produces larger particle size. Also, when such fires are caused by lightning strikes, the fires burn in the period following the storm when the atmosphere is generally more stable, allowing less rapid particulate dispersal.

Since man and other elements of the environment have been exposed to fire and wood smoke over evolutionary periods, they may have adapted to its effects in low concentrations.

The National Park Service is coordinating with the California State Air Resources Board to insure that all fire management activities are in compliance with eventual Federal and State standards. For this reason no significant deterioration of air quality is anticipated.

4. Soil and Water: Suppression of natural fires causes a build-up of nutrients in the forest floor with a corresponding decrease in nutrients available to vegetation. Over a period of time, mineral absorption by plants may be restricted due to an eventual drain on the soil nutrient reservoir (Behan, 1970). Prescribed and natural fires release the nutrients contained in the forest floor, and grasses, shrubs, and trees show elemental enrichment in many nutrients (Lay, 1956; Daubenmire, 1968; Stark, 1973). Following a light fire, soil acidity generally decreases due to the release of elemental calcium and magnesium and subsequent hydrolization, and organic content increases due to infiltration of partially combusted organic matter (Metz, Lotti, and Klawitter, 1961).

Effects of fires on soil biology are related to intensity and periodicity; light fires have little effect on either bacteria, actinomycetes, or mesofauna unless repeated on an annual basis (Jorgensen and Hodges, 1971; Metz and Farrier, 1971).

Erosion from light prescribed or natural fires is minimal where some forest floor remains, but soil type and slope are also important factors (Figure 13). Studies of infiltration indicate varying effects from prescribed fires; including decreases, no change, or increases following an original decrease. Where the over-story remains, raindrop impact is lessened, and a remnant forest floor protects soil from splash. Some erosion from fire suppression may also occur from the construction of fire breaks where they are oriented upslope, particularly where trenching is on the order of several feet in depth.

Effects on water quality from prescribed and natural fires have not been intensively studied, since in most cases, there seems to be little or no effect; similarly, effects from fire suppression have not been closely scrutinized.

Effects of evapotranspiration can change streamflow characteristics, and vegetation with greater root or canopy depth and higher density can transpire more water, reducing water

figure 13

A typical low intensity prescribed fire. Such fires are confined to ground litter and understory fuels and benefit soils through the recycling of nutrients.

tables and decreasing stream flow. This condition occurs more frequently in areas of fire suppression; whereas prescribed and natural fires can increase stream flow as well as riparian vegetation (Tabler, 1968; Houston, 1973). Rundel (1971) indicates that the giant sequoia groves represent a mesic segregate of the xeric mixed-conifer forests. The reduction of understory vegetation may be important in maintaining adequate soil moisture for the shallow-rooted giant sequoia.

River clearing reduces erosion created when trees uproot and fall into the river and eddies subsequently undercut the bank. The actual amount of soil so removed by perhaps 30 trees per year is minimal. Meadow restoration and grazing management will increase infiltration and decrease soil compaction and erosion by better regulation of recreational stock grazing. Due to the increased amount of growing plant tissue, some slight increase in evapotranspiration will occur. Relocation of certain trails out of fragile meadows and special trail design to permit unimpeded passage of water across trails remaining in meadows will reduce erosion, trampling and water channelization impacts. Construction of check-dams in meadow erosion gullies will stabilize soils and restore altered water tables.

5. Landscape and Aesthetics: Increased density of vegetation and advanced succession due to fire suppression results in greater uniformity of landscape. This can decrease the interest in distant views as there is less definition of features and less variety of light and sequence. At the same time, understory thickets make off-trail travel difficult and may reduce visitor use of the mixed-conifer and chaparral ecosystems. Along roadsides the thick growth of trees may be appealing to visitors unused to forests, but they also hide views that would otherwise be visible. Blackening of landscapes due to fires is reduced, but due to heavy fuel loads, more intense blackening may occur in areas which do burn under wildfire conditions. Wildflowers are also reduced due to the density of the forest canopy.

Prescribed and natural fires, by opening the forests and creating vegetative mosaics, increase interest in near and distant landscapes. More wildflowers grow, and chances to see wildlife through the open tree cover increases. Blackening occurs after fires, but is usually limited to the ground and smaller trees in fires of low intensity; after one winter much of the effect is erased. The control offered in prescribed fires allows the inter-mixing of blackened and green areas. Also, blackening is not always unaesthetic, as "cat faces" on the often-burned giant sequoias are amongst their most interesting features. Off-trail travel becomes easier, and decreased evapotranspiration may increase the

the flow in small intermittent streams. Smoke from natural fires may be an important aesthetic impact since it may obscure views of distant vistas or, by moving along drainages into Yosemite Valley, hide some of the Park's most popular attractions. If necessary, such fires could be suppressed or the effects ameliorated by interpretation of the role of fire in the balance of the ecosystem. The effects of smoke from prescribed burning can be mitigated by proper choice of prescription as discussed under the section on air quality, and by burning when visitor use is low.

When trees are removed to effect environmental restoration or vista clearing, landscapes such as open meadows and black oak woodlands will be recreated, allowing today's visitor to enjoy scenes similar to those viewed by the pioneers. In addition, vista clearing restores historic views of individual scenic attractions.

Preservation of lodgepole pine under attack by the lodgepole needleminer by spraying with a mixture of Malathion and diesel preserves the shade and cover in such areas and removes the need for revegetation of such areas. This is a positive impact. Since such areas are somewhat altered by the development and use they receive, the inhibition of a natural process here is only minimally adverse.

6. Socioeconomic Environment: Suppression of all fires around developed areas and roads offers maximum protection for these features at a cost not exceedingly high in comparison with their value. However, the use of prescribed fires to create buffer zones in one vicinity of development and to reduce fuel accumulations elsewhere, can decrease the possibility of catastrophic fires. Also, Truesdell (1969) reports that wildfire suppression costs in one area decreased by a factor of ten for the three years following a prescribed burn.

The possibility of prescribed or natural fires escaping from the Park is minimal, since in the first case, prescriptions can be chosen to hold fires within the Park and, in the second, natural fuel-breaks of rocky ground and sparse or absent vegetation occur where the Park boundary and natural fire management zones are contiguous. Also, Stanislaus National Forest bordering the Park on the north, is proposing to implement a natural fire management policy; the area concerned will be adjacent to a natural fire management area within the Park.

Visitor safety in regard to fire management is gained by temporarily closing areas of large natural fires to travel; prescribed burning is usually done during the spring or fall, when burning conditions are mild and visitation is at a low level.

Reduction of hazardous trees along roadsides and in developed areas decreases the possibility of property damage and personal injury or death, while an effect of vista clearing along roadsides is to decrease icy spots on the highways caused by shading, and to reduce the chance of motor vehicle accidents. Thus, both would increase safety.

Some inconvenience and very short-term opportunity losses will result from required closure of certain developed areas if and when such areas are chemically treated for lodgepole needleminer. Similar economic losses will be experienced by the concessioner and business interests in the Lee Vining area.

Where wood from hazardous trees is used for fuel other forms of energy such as electricity may be conserved. Much energy for seasonal National Park Service employees is derived from this source.

Some temporary inconvenience to visitors may result from the noise associated with chain saws used in hazard tree reduction or understory removal. The presence of 'slash' and work crews in the black oak woodlands represents a temporary aesthetic intrusion. However, both of these activities would occur mainly in spring and fall when visitation is at a low level.

Revegetation of developed areas will provide shade and aesthetic features; visitors will find these areas more desirable, and the eventual possibility of having to relocate denuded campgrounds will be eliminated.

Removal of trees from the Merced River reduces the potential for drownings as well as offering protection to bridges and shoreline development from the effects of log jams.

In the backcountry, grazing allows trips of increased length at reduced cost since carrying bulk feed is unnecessary. Also, trail crews use stock to facilitate maintenance activities, and grazing in nearby meadows curtails the need for pelletized feed and the extra stock necessary to supply it. Fencing attendant with grazing management will continue to cause minor inconvenience to backpackers.

7. Cultural Resources: There should be no detrimental impacts on any significant historic resource listed in Table 6 from fire management alternatives. Of these sites and structures only the Golden Crown Mine of Mono Pass is within a natural fire management zone, but it is at such high elevation that no fuel exists to carry a fire to the structure. The rest of these resources are within routine wildland fire suppression/prescribed burning zones. Where prescribed fires are designated for areas near historic resources, use of fire control lines plus careful regulation of fire intensity, rate of spread, and other factors through proper choice of prescription will make risks to these resources very low. In addition, prescribed fires help recreate the original historic conditions and by reducing fuel accumulations decrease the possibility of an uncontrollable wildfire which would destroy these sites or structures.

Archaeological resources may be affected by fire management alternatives. However, the exact amount of this impact is difficult to quantify both because sites in the backcountry have not been completely inventoried and their significance determined and because the effects of fire on various types of sites have not been studied. An archaeological survey studied backcountry areas in 1976, and a study has been proposed wherein prescribed fires with varying intensities will be monitored over sites prepared with different artifact types and any changes noted and correlated with burning conditions. The archaeological districts potentially eligible for nomination to the National Register of Historic Places (see Table 6) must be protected; in no case will any known cultural resource be subject to adverse effects without compliance with sections 2(b) and 2(c) of Executive Order 11593 and section 106 of the National Historic Preservation Act of 1966.

With regard to the effects of natural and prescribed fire on unidentified or nonsignificant cultural resources, the following should be noted:

It is known that natural fires burned over most Park areas for many centuries at various intervals, and recently, anthropological research has begun to document Indian burning patterns (Lewis, 1973; Bean and Lawton, 1973). The Indian fires probably substituted for natural fires by removing fuel that would carry the flame. Inferences have also been made that Indians increased the frequency of fire in many environments, and the journal quoted by Lewis (1973) substantiates this cultural burning pattern. Prior to the disruption of native American cultures and the advent of organized fire suppression 60 to 80 years ago, most sites that would be subject to natural or prescribed burning today were burned over countless times. Therefore, the impact of such fires on cultural sites and objects is limited to undiscovered artifacts of the last years of Indian occupation of the land, or undiscovered historic objects of a combustible nature. Sometimes fire may help to discover potential archaeological sites without any adverse effects on the site itself. In 1974, a wildfire burned in Carlsbad Caverns National Park and exposed a cave that had been covered by heavy brush (Carlsbad Current Argus, 1974). The exposed cave, plus two others discovered during the reconnaissance, have high archaeological potential and will be intensively surveyed.

The discovery of granite mortar sites followed the Shepherd Peak Fire of 1967 in the Three Rivers area near Sequoia National Park. Similar discoveries may result from prescribed and natural fires within the Park.

There is little chance of fire interfering with radio-carbon dating by allowing charcoal to filter into burned sites, because of the long history of natural and Indian fires. These fires have for thousands of years created charcoal at the surface that can percolate down to buried sites and mix with older carbon. Thus, a good deal of contamination has long been associated with all environments where natural fires or Indian fires occurred.

Prescribed fires may be used to recreate historical scenes, as most Indians who lived in forests used fire to manipulate their environments (Lewis, 1973). The maintenance of the historical scene is also a resource management objective in historical districts of the Park.

Since other vegetative resources management activities such as trail relocation, changes in drift fencing, or installation of boundary fencing may affect cultural resources, care will be taken that no adverse effect to such resources will occur (see Section IV. Mitigating Measures).

B. Impacts of Wildlife and Fisheries Resources Management

1. Vegetation: The restoration or reintroduction of the bighorn sheep could have an adverse impact on vegetation, but only if the number of sheep were to exceed the carrying capacity of the area. Before such a restoration, a study is proposed to determine the size of any remnant population, the historical range, and the extent and quality of current year-round range which should have increased as the bighorn population declined; use of the information gained from this study will ensure no adverse impact on vegetation from this project.

Restoration of black bears to natural foraging means that feeding sites would be dispersed over the available habitat rather than concentrated around campgrounds and developed areas. This would reduce pressures on plant communities used by bears as food sources adjacent to these areas. Removal of the exotic golden beaver will end the impacts it creates on vegetation. Among these is the consumption of riparian species such as black cottonwood, aspen, and willows for food, dams, and houses. Since the amount of these species is limited the beaver must eventually move to new habitats and start again leaving behind dams, houses, and denuded banks. Also, dams cause flooding of nearby meadows affecting succession and wildlife habitats.

The effects on vegetation of any possible phaseout of stocking lakes with fish would depend on whether a given lake could maintain a self-sustaining fish population capable of supporting sport fishing. Where a lake would be unable to support such a fishery, any damage to riparian vegetation created by the additional use associated with fishing, should be eliminated. The remaining lakes, which have sufficient natural recruitment to support a naturalized population and fishing, might experience a concentration of angler use derived from recently barren lakes which formerly supported sport fishing. Such a concentration of use might lead to riparian damage from increased circulation along the shores.

2. <u>Wildlife</u>: With implementation of the Human-Bear Management Plan, the removal of artificial food sources from the bear would reduce the present habitat's carrying capacity to a level approximating the natural carrying capacity. Over a period of years, natural population regulatory mechanisms would reduce the population to a level that the newly created carrying capacities could sustain. Among the natural mechanisms operating to reduce the population where intraspecific competition is pronounced would be decreased reproduction due to stress, increased cub mortality, delayed maturity, emigration, disease, intraspecific intolerance and decreased life expectancy.

Bears that fail to unlink from human food supplies, whose behavior seriously threatens the safety of Park visitors, or those that injure people, would be removed from the population. This number is not expected to exceed twelve bears per year, and would gradually diminish as the bears become habituated to natural conditions. The number of bears killed in control actions under a program of reduced but continued availability of artificial food has averaged nine per year in the three-year period 1972-1974 (none were killed in 1974). Bears removed from the population undergo euthanasia by intracardiac injection of pentobarbital sodium while under sedation; this method is an approved alternative in the recommendations contained in "The Report of the AVMA Panel on Euthanasia" (1972).

Initially, following complete removal of artificial food sources, the number of relocations may be expected to increase from the three-year average of 42; however, such actions may be expected to decrease as the population habituates to the natural environment and young bears are prevented from learning to use people-introduced foods. Bears being relocated undergo stress associated with the capture process including the temporary period in the culvert-type trap and the effects of the drug used for sedation during tagging. Sernylan (phencyclidine hydrochloride) has been recommended by both the Canadian Fish and Wildlife Service and the California Department of Fish and Game as the best drug for the use in such sedations; no long-term effects have been observed from its use, but temporary muscle constrictions and disorientation may occur. These bears also must define new home territories in competition with the bear population already in the area. Relocated bears that emigrate to areas outside the Park during the process of establishing new home territories would be subject to hunting mortality during the State's open bear season in accordance with State hunting regulations. In 1970 to 1974 the average annual legal kill as determined by hunter tag returns in Tuolumne and Mariposa Counties combined was 23.6 bears per year. The number of bears hit and killed by cars would be expected to decrease from the current three-year average of four per year to near zero.

Since programs relating to the deer herds are of an investigatory nature, there will be no direct impacts on deer. However, information gained from these studies will be useful in the formulation of management programs to ensure the perpetuation of natural populations and habitats of mule deer.

Restoration of the locally rare bighorn sheep will not affect Park wildlife, but since the winter range of the bighorn presumably includes areas of U.S. Forest Service lands which may be used by domestic livestock during summer grazing some interspecific competition may occur. In the past, such competition has generally favored the domesticated animals and may be responsible for reduced bighorn populations today (Jones, 1950; Buechner, 1960). Thus, concurrent studies of range requirements and availability and bighorn ecology will be important in the success of this project. If bighorn of the endemic subspecies are obtained in the southern Sierra Nevada and used to augment the remnant population, no significant alteration of the local gene pool can be expected. However, should British Columbian stocks of the California bighorn be used, some undesirable alteration of the local gene pool would probably occur. In spite of precautions, use of any bighorn stocks from outside the Yosemite region presents some risk of disease or parasite introduction. However, such risk would be minimal with southern Sierran stocks.

The restoration of the bighorn will help return the alpine ecosystem to its natural state.

The population of threatened Paiute cutthroat trout introduced into Delaney Creek in 1966 through an inter-agency program of the California Department of Fish and Game and the National Park Service, must be protected in accordance with the Endangered Species Act of 1973. These fish were originally planted in an isolated section of stream from which eastern brook trout were thought to have been removed to prevent interspecific competition. Although the Paiute population had increased to around 300 members, a remnant group of brook trout has since become large enough to threaten the Paiute population, which has now decreased to around 120 fish. In 1972, electro-fishing was started on an annual basis by the California Department of Fish and Game and the National Park Service to reduce the brook trout population as well as monitor the current status of the Paiute; at this time the brook trout to Paiute trout ratio is approximately 5.3 to 1.

The electro-fishing program has resulted in the destruction of approximately 650 exotic brook trout per year based on a two-year average. Electro-fishing stresses the Paiute population through shock and possibly by the momentary increases in salinity necessary for conductance.

In compliance with section 10 of the Endangered Species Act of 1973, a permit has been issued to the National Park Service which will permit the California Department of Fish and Game to remove virtually the entire Paiute population by electro-fishing and transport it to another site outside of the Park which has previously been prepared for it. Such a site would be free from interspecific competition and offer greater protection to the species.

If the California Department of Fish and Game does not relocate the population, it is probable that the Paiute population in Delaney Creek will succumb to the effects of interspecific competition from the brook trout population.

Programs for other threatened or endangered species are of a research or monitoring nature and will have no direct impact; nonetheless, the data gained from such programs will be important in ensuring the survival of such species.

The effects of vector control programs will be restricted to animal populations in developed areas which are potential vectors. Rodent populations such as the California ground squirrel, the golden-mantled ground squirrel and chipmunks have increased in number and density in developed areas due to the availability of human food. This increase makes the occurrence of epizootics and transmission of disease to people more likely. Reduction in these populations will not affect the species generally and will bring total numbers closer to natural levels.

The occasional carnivore such as the coyote or spotted skunk which is destroyed as a suspected rabies vector will not significantly affect the overall population. The incidence of rabies in these populations here is rare; control actions which may occur would probably be in response to population increases associated with human use or development and would reduce populations to natural levels and densities.

No euthanizing agent has been selected by the Federal Working Group on Pesticides for reduction of rodent populations; however, such an agent would be of a non-lingering nature and would not have secondary effects. Similar approval would be obtained for bait box pesticides and fumigants used in parasite elimination. Destruction of suspected rabid animals would be done with rifle or shotgun used on the body of the animal, since the brain must be preserved for analysis.

Eradication of the exotic beaver which is native in the Central Valley or California, will have minimal effect on other species. Some fish habitat will be reduced, but spawning area should increase (it should be noted that the fish themselves are not native to this area). Riparian animals should return to normal distributions as dams decay and revegetation occurs. The beavers will be destroyed with humane quick-killing Conibear traps or shooting where practical.

Removal of the exotic bullfrog will decrease predation on native frogs and increase the food supply available to them. The native red-legged frog, whose potential for survival within the Park is undetermined, has disappeared over much of the State as a result of predation by bullfrogs (Moyle, 1973); the threat to its survival should the bullfrog become widespread will be curtailed by bullfrog eradication. The control methods used will have minimal effect on other species as adults will be gigged and netted and the pollywogs will be either netted or removed by winter drainage of the ponds when activity is reduced.

The removal of both these exotics will help to restore the integrity of the natural ecosystem.

Should a phaseout of fish stocking be recommended after the two year cooperative study, the following impacts are probable: The direct effect would be on the 81 lakes which were receiving fairly regular restocking. Here, fish populations would adjust to the natural carrying capacity of the lake as influenced by the reproductive habitat, available nutrients, predation including fishing pressure, and physical habitat. For the rainbow trout which has relatively exacting spawning requirements necessitating a stream with a well-oxygenated gravel bottom, lakes would not be able to provide spawning habitats. For high lakes, inlet and outlet streams are commonly too steep and beset with barriers for spawning fish to regain entry to the lakes. For the brook trout, this would be much less of a problem. Consequently, populations of brook trout would usually be much less affected by any phaseout of stocking.

Many lakes have low fertility due to their snow-fed nature and granite surroundings. As a result, food production might be low and act as a primary limiting factor on population size. The abnormal proportioning of body to head size in brook trout is an indication of this process as well as an indication of the adaptability of the brook trout to this factor.

Parasitism and predation by cannibalism, birds such as kingfishers, ospreys, and sea gulls, and mammals such as the river otter might tend to reduce fish populations. Conversely, the more mobile predators would probably be forced to readjust themselves to those lakes which maintain larger fish populations.

Fishing pressure would tend to reduce populations particularly where intense. But fishing pressure itself would be self-regulating as populations and success rates drop, so that it alone should not cause lakes to become barren of fish. The lakes with greatest accessibility from roads or developed areas would be the most affected by fishing pressure.

The effects of the physical habitat would probably be the most important factor in determining whether a lake would become barren of fish. For high elevation lakes of shallow depth, winter kill and/or high summer temperatures and lack of oxygen can cause destruction of fish populations, particularly if repeated on successive years. In Nevada County, situated in the northern Sierra, repeated winter kill has removed rainbow trout populations in lakes of 20-foot depth and brook trout populations in lakes of 10- to 15-foot depth, at elevations of 6,000 to 7,000 feet.

Where fish populations in these lakes may have adapted to the particular stresses present, the elimination of stocking would mean that gene pools would not continue to be diluted by introduced fish not possessing these adaptations. The existing population might become stronger under these circumstances.

Where trout of one species were being introduced into lakes containing a reproducing population of another trout species, the interspecific stress should be reduced and the naturalized population (often brook trout) might be strengthened.

Where lakes would become barren of fish, an approximation of the pristine aquatic communities might reform. The migration of insects known to occur for 50 miles, as well as incidental reintroduction of species by birds would help recreate the original communities found in these lakes. For example, fairy shrimp, a desirable forage species for fish, might once more be found in high elevation lakes. The time required for this restructuring might be as long as 100 years.

Among indirect impacts on lakes containing naturalized fish populations, would be the possible increased fishing pressure due to a concentration of fishermen derived from previously stocked lakes showing a reduced fishery. These fish populations might be reduced until a balance is achieved due to decreased fishing success or possibly by adoption of special regulations. These fish populations might also experience a temporary greater predation from the more mobile predators such as kingfishers, ospreys, sea gulls, and river otters. If populations were reduced in these lakes, perhaps by intense fishing pressure, the river otter in particular might also show a population decline.

3. Abiotic Resources: There will be no significant impacts on air quality, water quality, or soils from wildlife resources management actions.

4. Socioeconomic Environment: Human-bear encounters associated with bears seeking human food supplies have resulted in property damage and personal injuries. Property damage has increased steadily since 1966, while a rapid increase in both property damage and personal injuries occurred in the period 1971-1974, following the closing of Park garbage dumps. The human-bear management program, described in the proposal, was implemented in 1975. Property damage increased in 1975, probably due to bears seeking human foods directly in the absence of garbage; however, in 1976, property damage declined significantly for the first time in ten years presumably because of the mitigating effects of rapid relocation of problem bears. Personal injuries decreased in both 1975 and 1976.

   Some relocated bears may transfer their human-food-seeking behavior to backcountry areas. How important this problem may be, will depend on the easy availability of natural foods versus the amount of effort to obtain human food. Special management techniques may have to be employed in those areas.

The strict sanitation and food storage requirements will necessitate more time and energy on the visitor's part; but the increased standards of solid waste collection and the stricter sanitation practices should result in improved environmental aesthetics as less scattering of trash by bears will occur. The information and educational programs on bear safety will represent an additional cost as will the improved garbage collection, special food storage cables, and specialized training of the Ranger staff.

The possibilities for visitors to observe bears in developed areas may be reduced, but the chance of seeing bears in natural surroundings would increase.

The restoration of the bighorn will require interagency cooperation as the winter range of these animals would probably be on U.S. Forest Service land. If so, the use of such winter range lands by the bighorn might restrict the amount of range available for commercial grazing.

The range containing the bighorn population might have to be restricted from public use in order to protect the animals from human pressure. Thus, some backcountry use would be transferred to other areas or the total number of users reduced. The chance of seeing a distant band of bighorn, however, might represent an important aesthetic benefit to many backcountry users.

The results of vector control will be increased public safety since epizootics in rodent or carnivore populations may be prevented, and the possibility of disease transmission to humans or injury from animal bites would be reduced.

A possible phaseout of fish stocking would adversely affect fishing in Park waters. Of the 81 lakes formerly on a fish stocking schedule, most would become barren of fish and support no angling. A few might continue to harbor reduced fish populations and might present a less attractive fishery in terms of angler success.

For the approximately 102 lakes which contain naturally reproducing fish populations and were not receiving supplemental stocking, fisheries should continue as before unless there would be a concentration of use derived from the formerly stocked lakes. Then total use might exceed natural recruitment and impair the fishery unless special regulations reducing creel limits and possibly imposing size and/or tackle restrictions were implemented.

Since the stocking of streams was discontinued more than ten years ago, the possible phaseout of all stocking should have little effect on stream fisheries. All 92 streams (880 miles) currently supporting fish should continue to provide angling opportunities.

Recent attitude surveys of fishermen on wild trout streams conducted by the California Department of Fish and Game indicate that the pleasure aspect of fishing and the challenge of catching larger "hard to catch" wild trout in attractive surroundings were more important than the number of fish creeled. These fishermen were willing to accept special regulations limiting the number of fish harvested in order to guarantee good natural reproduction and a stable fish population. Success rates for one of these streams were about .4 fish per hour fished, but other studies by the California Department of Fish and Game seem to indicate that a high success rate is not necessarily needed to satisfy fishermen on this type of water.

In Yosemite, it was estimated that 5.2 percent of the visitors to the Park fished during their stay during 1951 (Wallis, 1952). In the same year, approximately 1.25 million fish were stocked in Park waters, and this time period marked the greatest effort to create a fishery in the Park.

No recent survey exists, but it may be speculated that the percentage of visitors who fished during their stay in the Park declined as the fisheries program was deemphasized during the next 20 years. The current two year cooperative study by the National Park Service and the State may shed additional light on the socioeconomic aspects of recreation in this Park.

C. Impacts of Abiotic Resources Management

1. Vegetation and Wildlife: Natural vegetation will be encouraged by programs that stabilize abandoned trails and reconstruct others of faulty design or deferred maintenance.

2. Soil and Water: The programs dealing with obliteration and stabilization of abandoned trails will protect top soil and prevent deterioration of water quality through siltation.

3. Socioeconomic Environment: The information gained from the snow survey is important in the region and the State for purposes of prediction and proper utilization of water resources with regard to flood control, irrigation, hydroelectric power generation, and recreation. Within the Park important uses of the information concern scheduling of road maintenance and increasing visitor safety through avalanche prediction.

The water monitoring programs help to ensure good public health through their periodic sampling of water quality. Measurements of water flow validate information gained from the snow survey and are useful for downstream allocation of water resources.

The presence of gauging stations, water and snow monitoring stations, and snow survey cabins may represent an aesthetic impact for the Park visitor. On the other hand, snow survey cabins sometimes provide important emergency shelters.

IV. MITIGATING MEASURES INCLUDED IN THE PROPOSED ACTION

A. Direct Measures

1. Vegetation: Wawona Meadow is the only area in the Park still supporting grazing other than that incidental to a trip in the Park. During 1976 and 1977 grazing pressure in Wawona Meadow was reduced from the former level of approximately .27-acre per horse-month to above .7-acre per horse-month, the level at which the meadow is balanced between deterioration and improvement. All grazing there will be totally discontinued after 1977.

   Below 8,000 feet elevation, all coniferous trees felled with a trunk diameter of six inches or more will be treated with Borax to prevent the spread of annosus root rot through freshly cut stumps.

   Only five plant species proposed or designated as rare, threatened or endangered are positively known to occur in units where prescribed burning will be employed. One, *Lewisia disepala*, grows on bare, rocky domes and will not be affected by any prescribed burn. Prescribed burning will be excluded from all sites occupied by the other four species unless it is determined that one or more are fire-adapted. Six other species are listed as possibly occurring in the Park due to their presence elsewhere in the surrounding area. Five are foothill species and one an inhabitant of the mixed-conifer community. The naturally high fire incidence in these communities suggests that all or most of these plants are fire-adapted or inhabit sites protected from fire. However, unless the latter is established any individual plant or stand of these species discovered on a burn unit will be protected or the burn suppressed.

2. Wildlife: Stress on bears trapped for relocation will be minimized through the use of specially trained personnel who will use accurate dosages of the sedating drug and carefully monitor its effects and/or take corrective action, monitor traps so that holding periods will be minimized, and rapidly relocate tagged bears. Bears will be relocated to ideal habitats where natural carrying capacity is greatest.

   When any animal must be destroyed, e.g., as deemed necessary under the Human-Bear Management Plan, a method of euthanasia approved by the AVMA Panel on Euthanasia will be utilized. When any pesticide is used, it will first be approved by the Federal Working Group on Pesticides.

3. Abiotic Resources: Reductions of air quality by prescribed fires will be minimized by choosing combinations of fuel moisture, fire direction, velocity and direction of wind, and atmospheric stability, so that the quality, quantity, placement and dispersion of smoke can be controlled. Natural fires will be monitored and, if large quantities of smoke are being emitted under very stable atmospheric conditions creating unacceptable air pollution levels, fires can be suppressed. Air quality will be maintained within State and Federal standards.

4. Socioeconomic Environment: Aesthetic values may be preserved by timing prescribed burning to occur right at the beginning of the rainy season or just before the growth period in order to minimize the length of time blackened ground will remain. These fall and spring periods also correspond to lower visitation so fewer visitors will be affected by smoke obscuring distant scenes. Due consideration to landscape aesthetics will be given in choosing burn boundaries to eliminate box-like effects.

   Safety of visitors and their property will be increased by distribution of comprehensive bear warning information and by installation of special food storage devices in backpacker campgrounds. Where extensive natural fires are burning, some backcountry areas may be temporarily closed to prevent danger to the backcountry user.

   Public information regarding resources management programs, especially those involving fire, bear and fisheries management, will be accomplished through interpretive programs and contacts, short-range informational radio broadcasts, brochures, seminars, informational releases to the news media and scientific and informational reports.

   In order to comply with the National Historic Preservation Act of 1966 and Executive Order No. 11593, onsite evaluations of proposed prescribed burning areas will be made to prevent loss of large-scale unidentified cultural sites. Also, natural fires will be monitored and enclaves of cultural sites protected. Where fencing is proposed, lines will be surveyed to avoid disruption of cultural sites. In areas of fire suppression, vista clearing will restore some historic views for today's visitor.

B. Feedback Measures

1. Vegetation: To determine the actual effects of natural and prescribed fires on soil, water, fuels,

vegetation, and Park ecosystems, a three-year intensive study with continued monitoring is a proposed research project. Also, a one-year study is proposed to refine fall burning prescriptions; information derived from this study would offer more control of fire intensity, fuel consumption, and scorch height. The two programs, in conjunction, will be used in tailoring the fire management programs to meet ecological objectives.

2. Wildlife: The above two studies on fire management will also provide information used in proper management of wildlife populations.

   A research project is in progress studying the ecology of the black bear within the Park. Data obtained will include population characteristics, dynamics, productivity, density, distribution, circulation patterns, and available natural and artificial food. These data will be useful in determining carrying capacities and in modifying current human-bear management activities to reduce undesirable bear encounters and damage.

   Two studies of three years each are proposed to evaluate the historical range and current status of the bighorn sheep and to monitor the reestablished or reintroduced population. Similar range and status studies done by Jones (1950), Riegelhuth (1965), McCullough and Schneegas (1966) and Wehausen (1974) will form a basis for this work. Data gained will determine necessary characteristics of the reintroduced population or means of reestablishing the extant population and measures necessary for its successful continuation.

   A three year study would investigate the effects of a possible phaseout of fish stocking after the initial period of adjustment. The structures of the naturalized fish populations would be analyzed to determine how they had adjusted to inherent carrying capacity and fishing pressure. Riparian vegetation would be studied to determine the effects of any variation or redirection of use. Fisherman success and satisfaction would be surveyed. Further modifications of fishing regulations might result from this study.

   Various research studies will determine the status, dynamics, and available habitat of endangered, threatened, and status of undetermined species. Special management plans for such species will be formulated as necessary. These projects are enumerated in the List of Natural Science Projects and its accompanying phasing schedule in section I.

3. Cultural Resources: In compliance with the National Historic Preservation Act of 1966 and Executive Order No. 11593, an intensive archaeological survey is in progress. A one-year subsidiary study is proposed to determine the effects of fires of different intensity on artifact-substrate types. This information will be used in determining the necessity of archaeological enclaves within prescribed and natural fire management zones.

Any archaeological sites uncovered as a result of natural or prescribed fires will be properly inventoried in compliance with Executive Order No. 11593.

Before any ground disturbing activities such as fence construction or trail relocation are undertaken an archaeological survey will be made. Should any archaeological evidence be encountered during construction all further work would cease until the area was given onsite clearance by a professional archaeologist.

V. ADVERSE EFFECTS WHICH CANNOT BE AVOIDED SHOULD THE PROPOSAL BE IMPLEMENTED

Prescribed, natural and conditional fires will temporarily blacken the landscape; they also will cause limited air pollution. Enjoyment of scenic views will be temporarily reduced due to the interference of smoke. There is a slight chance that recent combustible cultural artifacts may be lost to fire if they are unidentified. There is also a very small possibility that such a fire might escape from the designated zone or across Park boundaries.

Zones of routine, wildland fire suppression will continue to accumulate heavy fuel loads and offer less useable wildlife habitat until manpower and resources permit prescribed burning. Resulting fuel loads will occasionally support wildfires of holocaustic proportions.

The continued limited interaction of bears with people will allow the continuation of property damage and personal injuries, while problem bears will be stressed in the relocation process. Fewer bears will be sighted by visitors in developed areas.

Until grazing is properly regulated in backcountry areas, some meadow deterioration will occur.

The restoration of the bighorn sheep might eventually require a restriction of backcountry use in a limited area.

Various wildlife management programs will result in the destruction of some animals; while this effect is totally adverse for the animals involved, the overall population or ecosystem will not be harmed.

The removal of dead, hazardous trees from developed areas will negligibly reduce habitat for woodpeckers and related species.

VI. THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Fire management zones and programs are designed to allow the natural interaction of fire with other ecosystem processes. In the short run, visitors may be inconvenienced by smoke, blackening and ash, and closure of certain areas when fires present a safety hazard. In the long-term, fuel accumulations will be lower, forest diseases reduced to natural levels, relatively natural mosaics of vegetative communities preserved, browse and forage increased, vistas more opened and varied, and cross-country travel made easier. Also, in the long run, some recent cultural sites of a combustible nature, unidentifiable due to dense ground cover and litter accumulation, may be revealed and then preserved or, conversely, may be destroyed and lost completely.

The restoration of black oak woodlands will result in temporary aesthetic drawbacks of slash pile-ups, chainsaw noise, and logging crews, but long run benefits from a restoration of natural woodlands and open vistas.

When hazardous trees are removed from developed areas, limited numbers of visitors may be momentarily inconvenienced by chainsaw noise and/or traffic slow downs, but all visitors, employees, and concessioners will indefinitely experience greater safety for themselves and their property.

The short-term effects of river clearing are the protection of bridges from being destroyed by log jams and a reduction in the potential for drownings caused by river snags; a long run effect, however, is the channelization of the river, preventing natural meandering and consequent effects of flooding in the maintenance of meadow communities. Environmental restoration projects to maintain meadow communities in the absence of natural river dynamics represent a long-term cost of this action.

The Human-Bear Management Plan will result in continued limited encounters between people and bears, continuing property damage and personal injuries in the initial period. It is predicted that, in the long run, bear incidents will decrease as positive associations with human foods are broken and that the black bear population will reach natural levels by natural means rather than by artificial reductions--a course of action currently contraindicated due to a lack of precise knowledge of black bear population dynamics.

The restoration of the bighorn sheep may require temporary closure of a limited area to general use, but will eventually restore ecosystem integrity and preserve the species in its original range.

VII. IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IN THE PROPOSED ACTION SHOULD IT BE IMPLEMENTED

Recent cultural artifacts of a combustible nature, unidentifiable due to dense ground cover, may be destroyed by prescribed or natural fire, an irreversible commitment.

Continued property damage and personal injuries resulting from human-bear encounters are irreversible commitments to the involved parties. Similarily, animals destroyed in implementation of wildlife resources management programs represent an irreversible commitment of those animals, but not of the total wildlife population resources.

VIII. ALTERNATIVES TO THE PROPOSED ACTION

As noted in the proposal, the primary objective of resources management programs is the perpetuation of natural ecosystem processes. In addition, these programs are designed to provide for approved public use while mitigating any adverse effects on the ecosystems occasioned by that use. These objectives are consonant with current Service policy and with those outlined in the act establishing the National Park Service, "...to conserve the scenery and natural and historic objects and the wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

Other potential combinations of ecosystem protection and provisions for public use were considered in the planning process; these alternatives and their associated impacts are delineated in this section.

A. Alternative 1 - No Action or Status quo

This alternative will continue resources management programs currently in progress. In many cases these programs are identical to those specified in the proposal; but in others, there is substantial deviation from the proposal. Differences between the proposal and current programs are delineated below.

1. Vegetative Resources Management: The use of prescribed fires would be limited to the intensive phase concentrating on major visitor attractions such as Yosemite Valley and the giant sequoia groves. The extensive phase would not be implemented.

   Understory removal in the giant sequoia groves would continue at the current rate of about ten (10) acres per year instead of the proposed 100 or more acres per year, while the removal of invading conifers in black oak woodlands would be treated on a sporadic and volunteer basis.

   Only a small fraction of the nine and a half miles of meadow trail in need of reconstruction or relocation would be accomplished annually. Other meadow restoration work such as check dam installation and lodgepole pine invasion removal would be foreclosed. Boundary and drift fences, exclosures and signs would be only intermittently installed and maintained as available personnel resources permit. Annual surveys of range readiness, condition and trend and stock carrying capacities would not be carried out nor would regulations be refined to reflect the above data.

Exotic plants would be removed only by natural death or as the result of prescribed or wildland fires. No vista-clearing would be accomplished.

Only 850 trees and 200 limbs would be removed annually in the annosus and hazard tree program. No use would be made of new guidelines developed by forest pathologists. Incense-cedar trees exhibiting symptoms of annosus infection would thus go largely unrecognized until they failed.

No actions to revegetate denuded developed areas or construction sites; carry out blister rust detection surveys and control of lodgepole needleminer infestations would be undertaken.

2. Wildlife And Fisheries Resources Management: To reduce bear access to human food sources, solid waste in campgrounds and concession facilities would be collected daily during the high-use season with weekly collections in residence areas and other government facilities. Cyclic maintenance and replacement of all refuse containers would be initiated. Thirty, four-cubic-yard, bear-proof, refuse containers would be purchased.

   No potential vector populations would be reduced unless supporting epizootic levels of disease transmissible to humans. Some animals would still be collected for disease determinations if animal bites should occur.

   Should research reveal that a viable population of bighorn is no longer present, no reintroduction of that species would be made.

   Populations of exotic animals such as the bullfrog and beaver would not be eradicated.

   The exotic population of Paiute cutthroat trout in Delaney Creek would not be relocated and would probably continue to decline.

3. Environmental Impact of the Alternative: The impacts described in this section are those resulting from the modifications of the proposal as called for by this alternative. A full description of the changes in the impacts with accompanying interactions is given here. Where the alternative is identical to the proposal, the impacts are the same, and reference should be made to section III for a complete discussion of these impacts.

   a. Vegetation: The majority of the mixed-conifer ecosystem (possibly 80%) and all the chaparral ecosystem would maintain their dense fuel accumulations due to the absence of fire. Nutrient recycling would be slowed and continued advancement to late successional species would occur with further declines in shrubs and forbs. Species would become more uniformly distributed offering less habitat variation. Since fuels accumulate faster than they decompose in these ecosystems, uncontrollable wildfire becomes a real possibility. Vegetation would then be returned to a very early state of succession; in any appreciable scale, such large oscillations would be unnatural.

The reduced rate of understory removal in the giant sequoia groves would mean that the sequoias would be stressed for a longer period of time by reduced water tables, impaired seed germination, and possible disease innoculation by (Fomes annosus), as well as potential destruction by abnormally intense wildfires.

The black oak woodlands would probably cease to exist in the next fifty years as conifers would suppress the mature oaks, out-compete the oak seedlings, and dominate the overstory. Eventually, the conifers in the same areas would probably be attacked by (Fomes annosus); but by the time that annosus had returned the conifers to a more natural density, the black oak woodland community would have been destroyed.

Erosion, altered drainage patterns, trampling and localized overgrazing of meadows with attendant adverse changes in vegetation composition and density would continue. Lack of adequate monitoring would not permit competent evaluation and regulation to avoid such degradation.

New guidelines and recommendations by pathologists for dealing with (Fomes annosus) and hazard trees would not be implemented. Approximately 230 trees and 150 limbs hazardous to people and property would go untreated annually. Eventual loss of most or all mature conifers from (Fomes annosus) in a number of Yosemite Valley developed areas would occur.

Openings in developed sites resulting from (Fomes annosus) and hazard tree, and forest pest control actions would not be revegetated, rendering such sites less natural and aesthetically less pleasing.

Infestations of lodgepole needleminers killing trees in developed areas would go untreated and would result in great losses of cover where natural reproduction is scarce or lacking.

Some reproducing, non-native trees such as the black locust (Robinia pseudoacacia) would expand their populations into new areas while other non-reproducing, non-native species would be removed by natural death.

The lack of vista-clearing would mean that historic vistas would contain unnatural forest densities for an extended period of time or perhaps indefinitely if the areas do not fall into the intensive phase of the management fire program.

No current data on the status of blister rust in the Park would be available after 1975.

b. Wildlife: The mixed-conifer and chaparral ecosystems would offer decreasing forage for deer and bear due to successional advances in the absence of fire. Progressively fewer shrubs and forbs would be available in forests while the density of thickets elsewhere would reduce available forage. The overgrowth of trees and established shrubs tends to store energy beyond the reach of wildlife. If uncontrollable wildfires eventually occur, as is probable, the return of vegetation to very early successional stages would offer improved forage to deer, bear and many other wildlife species.

The replacement of black oak woodlands by conifers would reduce acorn production to very low levels essentially removing this important food source from bear, deer, jays, woodpeckers, squirrels, band-tailed pigeons and other forms of wildlife.

Decreased habitat variety, as successional advances create more uniform vegetative conditions, would decrease the diversity of wildlife in the chaparral and mixed-conifer ecosystem. Small mammals and birds in particular would be affected.

In the absence of a viable population, no reintroduction of bighorn would result in that native species being unrepresented in the native fauna unless natural immigration from populations further south occurred.

Where meadows would be damaged by trampling, erosion, alteration of drainage and overgrazing, increases in ground squirrels which prefer the short grass might further hasten erosion. Other small animals might suffer increased predation due to the decrease in ground cover.

Vector populations in developed areas might possibly increase to levels capable of sustaining epizootics since access to unnatural foods permits high population levels and reductions would be made only during disease epizootics.

Improved solid waste collection would reduce bear dependency on human food sources requiring the population to use natural foods and to make population adjustments in the direction of a more natural density, distribution and sex/age structure.

The exotic bullfrog and golden beaver would not be extirpated in the Park; thus their territory would probably continue to expand, and native species such as the yellow-legged and the red-legged frogs would suffer.

A small and declining population of exotic and threatened Paiute cutthroat trout would probably continue to decline due to competition from eastern brook trout when other habitats free of competition are available outside the Park.

c. Abiotic Resources: Smoke from prescribed fires would probably be at lower total levels as large scale prescribed burning would not be practiced. However, since fuels in the mixed-conifer and chaparral ecosystems would continue to accumulate faster than they decompose, the uncontrollable wildfires which would probably occur would release large quantities of particulates without the possibility of choosing atmospheric conditions.

Nutrient build-up in forest floors would continue in areas previously scheduled for large-scale prescribed fires. Potentially, mineral absorption by plants in these areas might be restricted due to an eventual draining of the soil nutrient reservoir (Bhean, 1970).

Stream flow in areas which would remain unburned would be at lower levels due to a high rate of evapotranspiration from the dense forest community (Tabler, 1968; Houston, 1973).

Since meadow restoration activities would continue at such a slow rate, soil loss with erosion gullies might occur in areas of overuse with effects on both soil and water quality and quantity.

d. Socioeconomic Environment: For approximately 80% of the mixed-conifer forest, landscapes would tend to be very uniform, probably decreasing interest in views through less definition of features and less variety of light and sequences. Also the high density of the understory would tend to make off-trail travel difficult. The combination might reduce visitor use of this area.

Smoke from prescribed fires would be greatly reduced decreasing the chances of its interfering with distant scenes.

Since habitat restoration through prescribed fires would occur to a much lesser degree, permanent relocation of black bears might be more difficult. This might mean that unnatural human-bear encounters and property damage would remain high. On the other hand, improvements in solid waste collection would reduce human-bear encounters resulting in damage and injury. Costs for this level of improvement would be a one-time expenditure of $27,700 and an annual increase to the existing program of $32,300.

This alternative level of (Fomes annosus) and hazard tree control would soon result in annual property damage and fatalities exceeding $10,000 and 0.3 respectively. Eventual loss of all or most mature coniferous cover would constitute a severe aesthetic impact while the temporary loss of facilities would constitute a serious economic loss to the concessioner and an opportunity loss to those visitors desiring to use such facilities. Injury or death would be severe personal impacts to anyone so affected. Program costs would be approximately $156,600 per year.

A lack of vista-clearing activities would decrease distant landscape visibility; along roads, fewer vistas would be seen through the tree-lined corridors. In addition, a dangerous condition attributable to the build-up and maintenance of certain icy spots on roads would not be ameliorated by vista-clearing.

Lack of control of needleminer infestations could result in most tree cover being killed in several developed areas supporting primarily lodgepole pine cover. In that visitor-use there prevents natural reproduction of that species or any other tree, the eventual lack of tree cover would probably greatly reduce visitor comfort and aesthetic values in such areas.

The potentially high levels of vector populations in developed areas might result in epizootics with the possibility of human infection by plague or rabies.

The decrease in prescribed fires may result in some cultural sites not being located due to dense brush and ground cover, thus making proper preservation difficult. At the same time some recent combustible artifacts, unlocateable for this same reason, may not be damaged as long as fire suppression is effective.

4. <u>Mitigating Measures, Unavoidable Adverse Effects, Short-term Versus Long-term Relationships, and Irreversible or Irretrievable Commitments</u>: There are no mitigating measures inherent in the modifications called for by this alternative.

Should modifications specified by this alternative be implemented, the following unavoidable adverse effects would ensue. The black oak woodlands would be ultimately eliminated as would all or most coniferous vegetation in a number of Yosemite Valley developed sites. Lower elevation vegetation would tend to be uniform and dense, with reduced wildlife habitat and browse and increased probability of uncontrollable wildfire. Wildlife would be less diverse; deer populations would probably decrease, while decreased bear habitat would probably increase the number of human-bear encounters. The exotic bullfrog would extend its distribution throughout large areas from which it would be impossible to remove, while the non-native beaver population would continue to cause damage to riparian environments and expand its distribution. Backcountry meadows would be degraded by overgrazing, through overuse of trails, and by erosion. The potential for human infection by vectored diseases would be increased. Historic views and scenic vistas would be few; cultural sites would be more difficult to locate.

Short-term advantages of the alternative would be reduced costs of resources management programs; in the long-term, however, the natural environment would show larger and larger deviations from its pristine condition with eventual impact on the potential for visitor enjoyment. A decision not to treat needleminer infestations which threaten the existence of tree cover in several developed sites would have some small short-term benefits to passerine and other birds - non-threatened or endangered - and various species of insects. However, long-term impacts are likely to be adverse to both the birds and insects since these particular lodgepole pine habitats would probably be altered to a non-forest condition for a long period of time.

Irreversible commitments of resources would occur through the loss of the black oak woodlands and large areas of meadow, which would become forest at an accelerated rate. Some minor and very localized genetic changes to ponderosa pine might occur near Wawona due to the planting there of ponderosa pine nursery stock of another strain. Exotic trees, bullfrogs and golden beaver would become widely established and degrade the natural environment by their presence. Damage to physical facilities, injuries and loss of life from annosus infected and other hazardous trees and limbs would constitute irreversible commitments of resources.

Irretrievable commitments of resources would be unnatural vegetative uniformity and density, the relative scarcity of wildlife numbers and species and the somewhat altered condition of certain lakes, streams and meadows.

B. Alternative 2 - Emphasis On Natural Resources Preservation And Restoration.

This alternative is similar to the proposal except that, as indicated below, emphasis has been placed on protection of the resource in some cases of conflict between resources protection and provisions for visitor enjoyment. This has meant limitations or alteration of some types of use.

1. Vegetative Resources Management: No fire of natural origin would be extinguished in Natural Fire Management Units. Prescribed burning would be expanded over that described in the proposal and continued during periods of high visitor use and under conditions where large amounts of smoke would be produced for relatively long periods.

No grazing or other use of pack and saddle stock would be permitted within the Park. The spring opening of the Tioga Pass Road would be delayed until the Tuolumne Meadows were no longer water saturated. Meadows would be restored by restricting hiker use of trails until the meadows were sufficiently dry, or until trails in forested areas skirting meadows were sufficiently free from snow to be useable. All drift fences and stock facilities except for some boundary fencing would be removed. Protection patrols would enforce use restrictions described above.

In the reduced developed area of Yosemite Valley all coniferous trees would be removed within 50 feet of each annosus infection center and trenches sufficient to sever all root connections would be excavated and maintained. Resulting openings would be revegetated with nonsusceptable, native hardwood species. In developed sites throughout the remainder of the Park hazardous trees and limbs would be removed as described in the proposal.

Revegetation work in Yosemite Valley would be carried out at the proposed level but be directed primarily towards revegetation of former developed areas. Elsewhere it would continue at plan level without directional change.

Bark beetle control actions would be the same as the proposal except for some reduction in such actions commensurate with reductions in development and use.

Lodgepole needleminer infestations would be controlled by one of two applications of pure Malathion or other suitable chemicals:

a. Malathion applied in an ultralow volume spray without diesel carrier at a rate of about one pint pure Malathion per acre.

b. High volume application of Malathion applied by mist blowers on the ground at selected trees.

c. Use of better chemicals if available.

All exotic trees and shrubs other than those on lands nominated for National Landmark Status and all herbaceous species that could be controlled would be eradicated.

No action would be taken to remove trees and logs from the river and creeks in Yosemite Valley unless actually threatening bridges or in imminent danger of doing so.

Vista-clearing would be carried out only in those few areas where trees shade roadways and create dangerous and persistent icy spots during winter months.

2. <u>Wildlife And Fisheries Resouces Management</u>: Vector control and all bear management activities including those associated with solid waste removal would be the same as the proposal except that the level of activity would be scaled down commensurate with reductions in development and use.

   No fish would be stocked in Park waters, and no fishing would be permitted on the lower reaches of the Tuolumne, Merced, and South Fork Merced River drainages, where fish were originally active.

3. <u>Environmental Impact of the Alternative</u>: The impacts described in this section are those which would result from the modifications of the proposal as called for by this alternative. A full description of the changes in the impacts with accompanying interactions is given here. Where the alternative is identical to the proposal, the impacts are the same, and reference should be made to section III for a complete discussion of these impacts.

   a. <u>Vegetation</u>: Since no natural fires within Natural Fire Management Units would be suppressed, and prescribed fire would replace all mechanical understory removal in sequoia groves and much of such removal in black oak woodland restoration, fire would burn larger total areas and accomplish more fuel reduction, successional alteration and other restorative measures than would implementation of the plan proposal. This should result in a more natural ecosystem.

Meadows would no longer be damaged by grazing or trampling by pack and saddle stock. Similarly, early season restrictions on use would greatly reduce trampling by hikers. When meadows are saturated the fragility of the substrate increases while the potential for breaking through the turf also increases (Harvey, Hartesveldt, and Stanley, 1972). Both of these can contribute to the formation of ruts in meadow trails, with erosion, possible water table depression, and associated invasion of meadows by woody species. Use would occur when meadows are drier and less susceptible to this influence or when alternate trails through less fragile forest perimeters were free from snow.

Although developed areas in Yosemite Valley would be reduced, removal of all coniferous trees within 50 feet of all annosus infection centers in remaining developed sites would initially result in an increased number of annosus-infected trees being removed. Although reduction in development would require considerably less other hazard tree and forest insect control actions, total removals for all of the above listed actions might initially exceed that for the proposal. However, after the initial period, removal totals would be far less. Outside Yosemite Valley hazard tree and forest insect control actions would be carried out at the level of the proposal, and impacts are as described in section III.

Revegetation of former developed sites and annosus infection centers in Yosemite Valley would initially be greatly increased over that specified in the proposal. Following those initial actions, revegetation in Yosemite Valley would be at a vastly reduced level. Elsewhere in Park developed areas revegetation actions would be identical to those of the proposal and impacts would be as described in section III.

Since the Yosemite Valley was far less forested prior to its discovery by modern man, loss of coniferous tree cover is consistent with restoration of prehistoric conditions. Revegetation projects would increase the area occupied by the California black oak, which was formerly more abundant. Thus such actions would have a positive environmental impact.

The total ecosystem would be closer to natural condition with the increased removal of exotic plants.

Curtailment of all but emergency tree and log clearing on the Merced River would permit trees to fall into the river and logjams to form. Both of these actions tend to encourage breaks in the river bank and natural and periodic course changes, meanders and localized flooding of the river. Such processes tend to restore riparian species, raise water tables and maintain a more natural balance between meadows and surrounding forests and woodlands.

No adverse effects on vegetation would be expected from needleminer control by Malathion or other chemicals that would be used.

Impacts of vista-clearing would be the same as those described in section III but of a much reduced scale.

b. Wildlife And Fisheries: As described in section III, the occurrence of fire under natural or naturally simulated conditions would improve browse and other forage for many species of wildlife. Animals of riparian habitat should find more available territory as river flooding and meandering creates a larger riparian zone. At the same time meadow communities should function more normally, preserving niches currently threatened by forest succession or meadow degradation.

Trenches around annosus infection centers would seasonally retain water, and under this condition the trenches would constitute local hazards to small mammals such as voles, deermice, gophers, moles and shrews. Hazard tree and forest insect control removals would adversely affect some animals while the revegetation of these openings would benefit others. As such changes would be in the direction of a more natural distribution of vegetation such impacts should be beneficial.

Research strongly suggests that previous applications of Malathion to control lodgepole needleminers had no immediate, measurable, deleterious effects on wildlife other than an indirect effect resulting from a general insect kill (Keight and Killpack, 1963). Therefore, either of the alternative uses of Malathion would probably have even less adverse effects since use per acre would be lower. Alternative use of a "better" chemical would require effectiveness on the target species and less environmental impact.

Impacts associated with vector control and bear management would be the same as those listed in section III but at a reduced level commensurate with reductions in development and use.

Fish populations would adjust to effects of natural predation, climatological conditions, and the availability of food and reproductive habitat. Thus some lakes might become barren due to winter kill or lack of appropriate reproductive habitat. In others, food supply might be the limiting factor. Predators would not have to compete with fishermen for this food source in waters where fishing would be prohibited. An approximation of pristine aquatic communities might reform. However, king salmon (Oncorhynchus tshawytscha) would be unable to reach the lower portions of the Merced and Tuolumne Rivers within the Park due to dams situated below which block all upstream migration of fishes.

c. Abiotic Resources: Large amounts of smoke might be present in drainages during the late summer when natural fires might be burning that would be extinguished with implementation of the proposal. This might result in high levels of air pollution in Yosemite Valley when combined with auto emissions.

Soil loss through erosion in meadows and the reduction in water quality through siltation should be decreased since less meadow damage should occur. Some small decrease in water quality might occur in the Merced River as banks are undercut during meandering or in flooding. An unknown increase in stream flows and duration of flows should result from fire and meadow management.

d. Socioeconomic Environment: Some potential increase in smoke levels from natural and prescribed fires might adversely affect the eyes and respiratory tracts of Park residents and interfere with distant views. Smoke might also become dense in Yosemite Valley, obscuring views of its features until dispersed by afternoon updrafts. Where a large natural fire burns for a long period, some visitors might not find unobscured views during their entire stay.

Landscapes would tend to be somewhat more varied due to the vegetative mosaic created by more natural and prescribed fire. Reduction of understory vegetation should enhance cross-country travel and increase wildflowers and streamflow slightly over levels that would result from implementation of the plan. In areas recently burned, somewhat more scorched vegetation and blackening would persist for several years.

Possible reductions in Yosemite Valley development would result in similar reductions in opportunities for visitor-use and enjoyment. However, the more natural environment resulting would benefit those visitors who could appreciate Yosemite Valley in a more natural condition. Reduced Valley development would represent an adverse economic impact to concessioners, some employees and other business interests. Initial costs for annosus control and revegetation in Yosemite Valley would be much higher than those of the proposal but would fall far below that level after the initial period.

Minor restrictions on backcountry use would result in redirection of trips to other available and less susceptible areas. Elimination of all stock use would decrease the total number of different equestrian activities that could be enjoyed in the Park, with a concommitant loss of revenue to the major concessioner and permitted packers. The total use of the backcountry would be reduced during the wettest part of the spring and early summer. Some redistribution of use to adjacent National Forest areas without similar restrictions might occur. The later opening of the Tioga road would restrict travel into the Park, interfering with access from the east and potentially having economic impact on the region east of the Sierras such as Lee Vining, Bridgeport, and Bishop. Also, some decrease in concessioner revenue would be caused by the possible later opening of the High Sierra Camps.

Socioeconomic impacts resulting from vector control and all bear management activities would be the same as those described in section III but reduced in scale.

Reduced river clearing operations would eventually result in the loss of one or more low bridges, and probably one employee campground and various road, trail and utility systems. These losses would represent economic impacts.

Slightly increased quantity, quality and duration of streamflows should have some positive impacts on visitors, National Park Service, Concessioners, and downstream water users.

The most recent survey of fishing use in the Park (Wallis, 1952) indicated that approximately five percent of the visitors fished during their stay; for some, this was an incidental part of their trip. Reduced stocking since that study might have reduced the percentage who fish. For these visitors a certain degree of dissatisfaction might be experienced and some would probably use adjacent National Forest lakes and facilities, increasing the pressure at these areas.

Unidentified cultural objects might be disclosed by the removal of ground cover after a fire; they would then be properly inventoried. Hidden objects of a combustible nature, remaining from the period after fire suppression became effective, might be consumed by such fires. These effects would be slightly more pronounced due to somewhat increased natural fire activity.

Cutting of banks by erosion during river meandering is an important factor in revealing archaeological sites. The renewal of the meandering process in Yosemite Valley might contribute to the location of additional archaeological resources. Any such resources would be inventoried in compliance with Executive Order No. 11593 and the National Historic Preservation Act of 1966.

4. Mitigating Measures, Unavoidable Adverse Effects, Short-term Versus Long-term Relationships, and Irreversible or Irretrievable Commitments: The following direct mitigating measures are included in the modifications specified by this alternative. Management fires resulting from natural and prescribed ignitions would be interpreted to increase the visitor's awareness of fire's role in natural ecosystem dynamics. Visitors would also receive printed information and personal contact by Ranger personnel in order to increase their understanding of the purposes of feeding regulations in reducing bear and vector populations to natural levels. Trenches resulting from annosus control would be fenced, boarded over and signed to provide for visitor safety.

Indirect mitigating measures are feedback actions which include all previously listed Natural Science studies proposed or in progress and one intensive archaeological survey. These studies and surveys will provide the necessary monitoring for refinement of the above-listed alternatives.

Should this alternative be implemented, the following unavoidable adverse impacts could be expected. The slightly larger extent of the management fire program would probably produce a higher level of particulates in drainages including Yosemite Valley. Air quality would be more frequently reduced and distant views would be partially obscured. Some increased blackening of the ground and tree bases would occur. Some additional recent and combustible cultural objects might be destroyed where conditions made their identification impossible. The seasonal regulation of backcountry use would reduce total use and trip variety in late spring and early summer, while the delayed opening of the Tioga road would affect the economic condition of the region on the east side of the Sierra as well as some concessioner operations. Additional costs would be associated with the relocation of development from Yosemite Valley and the additional enforcement and information programs related to fire, bear management and vector control. Visitor enjoyment might be reduced for some with the reduction of fishing opportunities as well as by the removal of trees.

In the short-term, the larger number of management fires required to expedite restoration of natural conditions would inconvenience visitors with smoke and obscured scenery; once the initial high fuel load was reduced, however, the number and intensity of fires would drop to a low level necessary for maintenance of the ecosystem, while more open conditions and varied scenery would increase aesthetic enjoyment. Costs for relocating development from Yosemite Valley would be very high in the short-term. Eventually, however, Yosemite Valley would be closer to its pristine condition and offer visitors a chance to experience conditions which should become increasingly rare elsewhere.

Trenches, openings and revegetation work resulting from annosus and hazard tree control operations would be disruptive and adversely effect short-term use of those developed areas. However, since the above actions would restore more natural conditions, long-term effects would be beneficial to the environment.

Chemical control of the lodgepole needleminer would require the closure of all of the treated area for a week or more. Adverse short-term impacts would be felt by unaccommodated visitors and others disturbed by the treatment.

The concessioner and other adjacent business interests might experience minor, and very short-term losses of revenue as a result of the above. The long-term impact would be beneficial in that tree cover would be preserved on impacted sites currently incapable of sustaining adequate natural regeneration of trees. As a result, sites would be more attractive to campers and picnickers, and long-term concessioner revenue would probably be better.

The cost of relocating development from Yosemite Valley to other locations and the possible loss of one or more low bridges, one campground, roads, trails and utilities due to a reduction in river clearing operations would represent irreversible commitments of economic resources. The decreased total capacity of the backcountry, the reduction in angling opportunity, the elimination of stock use, and the reduced business opportunities in the Park and the region east of the Sierra would represent irretrievable commitments of the socio-economic resources.

C. <u>Alternative 3 - Emphasis On Visitor Use</u>

This alternative differs from the proposal only as outlined below where more manipulation of the resource would be undertaken in order to provide additional opportunities for visitor enjoyment.

1. <u>Vegetative Resources Management</u>: Natural and prescribed fires would not be permitted from Memorial Day to Labor Day in order to reduce the possibility of smoke interfering with the visitor experience. All wildland fires would be suppressed promptly between Memorial Day and Labor Day including those in Natural Fire Management Units. At other periods of the year such fires would be managed as described in the proposal except that no loose-herding of fires would be undertaken. Prescribed burning would be restricted to no more than 3,000 acres annually. Except in sequoia groves and black oak woodlands, mechanical removal of understory vegetation would be greatly expanded to substitute for restrictions in prescribed burning and related fire management programs. Actions for the control of bark-beetles would be the same as proposed except for some increase in such actions commensurate with increases in development. Control of lodgepole needleminer infestations would utilize acceptable agents and systems such as those listed below when available.

   a. <u>Systemic Insecticides</u>: Insecticide could be applied by air to target area at any point in the insect's life cycle.

   b. <u>Herbicides</u>: Defoliate trees and thus starve insects in the needles without killing trees.

   c. <u>Biological Control</u>: Use biological control if an acceptable agent can be found.

   d. <u>Sex Pheromone</u>: When developed, such an agent could be employed to interfere with mating in and near affected developed areas.

   e. Various combinations of some or all of the above.

Grazing at Wawona Meadow and Big Meadow would be used to recreate historic uses of the land for interpretive purposes. Big Meadow would continue to be irrigated. Backcountry grazing would be supported by construction of additional drift fences and stock facilities along certain trails and by setting proper stock-use capacities phased to the season. All non-reproducing woody exotics would be left in place where they increase the aesthetic qualities of the scenery. Ornamental plants and non-native species of grass could be used around residences and operational facilities.

2. Wildlife and Fisheries Resources Management: Black bears would be fed at feeding areas away from campgrounds or other developed areas. This would provide opportunities for the public to safely view bears while simultaneously attracting the bears from campgrounds and other developed areas. Concurrently, bear-proof storage for food and bear-proof garbage disposal would be provided in campgrounds and other developed areas. Bears committing depredations in developed areas would be subject to nuisance bear control as in the proposal. Vector control activities would be identical to those of the proposal but increased in scope commensurate with increases in development and use. Supplemental stocking of lakes, with rainbow trout only would occur with the following exceptions:

   a. Lakes that exist in original barren state; fishes never introduced - approximately 61 lakes.

   b. Introduced fishes failed to become established in certain lakes, or became temporarily established and subsequently disappeared - approximately 32 lakes.

   c. Lakes that contain adequately self-sustaining and fishable populations - approximately 102 lakes.

   d. Watersheds accessible to fish that contain species designated as endangered or threatened by the Federal or State governments or considered locally rare, whose welfare could be reduced by stocking - one at this time.

   This alternative would result in approximately 63 lakes being routinely stocked, with ten more in undetermined status.

   The exotic golden beaver would be permitted to remain in currently occuppied habitat and extend its distribution in the Park without control. Eventually this exotic mammal could become established over much of the lower and middle Park reaches of the Tuolumne River, its tributaries and possibly the Merced River drainage. The exotic bullfrog would be allowed to become established and eventually more widely dispersed in the Park.

3. Environmental Impact of the Alternative: The impacts described in this section would be those resulting from the modifications of the proposal as called for by this alternative. A full description of the changes in the impacts with accompanying interactions is given here. Where the alternative is identical to the proposal, the impacts would be the same, and reference should be made to section III for a complete discussion of these impacts.

a. Vegetation: Since natural fires would not be permitted to burn until after Labor Day and prescribed burning would be greatly curtailed, the influence of fire on vegetation would be greatly decreased. Thus over the long-term the extended period between natural or prescribed fire for any given area should result in more advanced plant succession, denser vegetation and more intense wildfires than would occur with shorter period fire-cycles.

Increased fire suppression would result in increased tree-felling, fireline construction, litter and other alterations of the natural environment that come with such actions. The mechanical removal of understories in areas which are no longer suitable for management fires because of too much fuel moisture during the permitted period, would favor early successional species but would lack some of the nutrient recycling and seedbed preparation features of fire. However, the potentially large acreage subject to this action might make it infeasible, particularly in remote and relatively inaccessible areas.

In other areas subject to management fires, decreased time in which to use prescribed fires as well as restrictions on acreage which could be burned annually would mean longer intervals between burning, with effects similar to those described above.

Unnatural vegetative conditions would result from the persistence of exotic woody plants as well as from the manipulation of the landscape for aesthetic purposes. Mature healthy trees, normally resistant to natural pathogens, might be removed to improve views of scenic features. Ground cover and shrubs might be unnaturally maintained at one particular successional point where this is an important part of creating a vista.

Front country meadow vegetation would be minimally affected by the light level of grazing used to demonstrate historic uses. The continued irrigation of Big Meadow would help maintain the meadow in its present extent, slowing the natural successional advance occurring there when the meadow was first manipulated to improve grazing.

In backcountry meadow areas designated for stock use, adherence to proper carrying capacities and seasonal use planning could result in very little damage to meadow areas. However, through the normal equine eliminative process as well as through the use of grain and pelletized feed, there is a possibility for the introduction of exotic grasses and forbs.

Impacts from bark-beetle control would be as described in section III except for an increase in magnitude commensurate with increases in the program level.

Use of a herbicide defoliant to control needleminer infestations would weaken trees and render them more susceptible to other pathogens. Use of systemic insecticides, a sex pheromone or biological control would have no significant adverse effects on vegetation.

The concentration of bear activity immediately around feeding areas might result in some deterioration of vegetation in these areas due to overuse.

The additional use associated with fishing of stocked lakes might cause increased shoreline damage. This possible effect would be investigated in a study on fishing use in the backcountry.

b. Wildlife and Fisheries: The longer period fire cycle would result in large oscillations between forests clogged with understory trees or communities of dense, mature, interconnected shrubs, both with little forage or habitat for wildlife; and early successional phases where prevalent herbaceous forest understory vegetation and shrub communities tend to be younger and far more productive to most forms of wildlife. This contrasts with a shorter period cycle, where oscillations around more vigorous, productive communities are smaller.

Where mechanical understory removal would be substituted for prescribed fire, certain species requiring fire for seed germination would be reduced. This would reduce browse and forage for deer and bear and other animals. Also due to slow nutrient cycling, nutritional value might be reduced.

Use of a systemic insecticide to control lodgepole needleminers would probably kill most insects feeding on treated trees. As a result short-term adverse effects would be reflected in changes in distribution and density of some birds and other insectivorous species. No insecticide capable of producing death or serious pathologic conditions in vertebrates would be employed. Use of a herbicide defoliant in needleminer control would alter habitat in treated trees for a number of animal species until needle growth was completed. Provided an acceptable biological control agent or sex pheromone can be developed, no direct adverse effect on wildlife or fisheries would be expected.

Where drift fences would be installed for stock pasturage in backcountry areas, competition for forage in and around these areas could reduce forage available to some forms of wildlife while increasing forage for others. In that stock are not native to this Park, such impacts would be detrimental.

Black bears would be concentrated in feeding areas and would become highly dependent on artificial feeding for survival. This would cause extreme intraspecific competition and stress with the creation of an artificial selection process which might change natural population characteristics. Social strife and the establishment of an unnatural social hierarchy would result. Natural behavior, distribution, and foraging habits would be greatly altered. Additionally, population levels would remain above the natural carrying capacity with the resultant tendency for stressed bears to attempt to obtain food under less stressful circumstances. Again, natural population structure would be impaired. Where bears would be relocated or destroyed the impacts would be as described in section III.

Vector control impacts would be as described in section III but increased to a level commensurate with the increased scope of the program.

Exotic populations of golden beaver and the bullfrog would not be controlled and populations would probably expand into all habitable niches. Beaver would alter the environment by cutting riparian tree vegetation and by the construction of dams, ponds and canals which would cause water to inundate naturally moist and dry lands. Damming of streams inundates fish spawning sites in the areas where fish are native and other areas where introduced populations are established.

Bullfrogs prey on native yellow-legged and the rare red-legged frog, and might locally reduce the latter species to extremely low levels.

Where severe climatic conditions, or lack of spawning sites would eventually cause the loss of an existing fish population, continued stocking would perpetuate a fish population and prevent the eventual restructuring of aquatic communities similar to those existing in pristine times. Where a trout population already exists in a lake, the supplemental stocking would tend to dilute the gene pool and act to prevent the strengthening of the population through natural selection. Predators, however, would find more lakes containing larger fish populations, and this would tend to increase the capacity of their available habitat.

c. Abiotic Resources: The suppression of all fires during the period from Memorial Day through Labor Day would, if effective, reduce smoke levels within the Park to very low levels. In areas where management fires would not be within prescription during the remainder of the year and if such areas are too large and relatively isolated to make mechanical thinning practicable, the potential for uncontrollable wildfire would be high with a resultant release of large amounts of smoke without regard for timing or direction.

Nutrient build-up in forest floors would be high in some areas subject to mechanical removal of the understory. This would affect soil quality, and, potentially, mineral absorption by plants in such areas.

If understory removal in large areas proves impracticable, reduced streamflow can be expected as a result of a high rate of evapotranspiration. This condition would worsen until management fire or wildland fires reduced vegetative cover.

d. Socioeconomic Environment: Due to the reduced number of fires during the summer season, the chance of smoke interfering with distant views or the accumulation of smoke in drainages such as Yosemite Valley would be minimal, except when wildfires were burning.

Landscapes would be less varied as the longer-period fire cycle with its larger fuel accumulation would tend to interfere with the mosaic effect produced by natural fires of normal frequency. In areas where mechanical thinning is used to simulate the effects of fire more uniformity would be expected.

The large area contained in the red fir and white fir communities, which would normally be maintained by management fires, would need some additional form of treatment to maintain the natural vegetative conditions since some areas would come within proper burning conditions primarily during the summer months. The removal of understory vegetation by mechanical thinning is an expensive alternate method (approximately $1000/acre). The acreage potentially subject to this treatment is difficult to estimate but may include areas on the north slopes of ridges and drainage bottoms. If twenty percent of the total red fir ecosystem were contained in these areas, approximately 30,000 acres would need treatment on a periodic basis. Many of the areas are relatively isolated, thus logistic support to crews working these areas would be very difficult, decreasing the feasibility of such projects.

The resetting of stock-use capacities to reflect seasonal variations might slightly decrease the variety of potential trips. The provisions for drift fences and other facilities for the separation of hiker-rider use will provide more conveniences for stock users, as well as backpackers, but such facilities may be offensive to some non-riders.

The use of landscape architecture techniques to structure vistas would increase the aesthetic qualities of these views for many visitors. Some visitors, however, might dislike the fact that the scene would no longer duplicate what might have been seen in the pristine condition.

The presence of non-reproducing exotic trees might increase the aesthetic quality of many scenes as well as provide a link with the Park's early history, but would reduce the similarity to the scene viewed by the first non-Indian visitors.

Use of systemic insecticides, herbicides or biological control of needleminer infestations would require closure of treatment areas for an indefinate period. Closures would result in some visitors failing to be accommodated and others being disturbed by the treatments. Also, closures would probably result in slightly decreased revenues for the concessioner and adjacent business interests.

Additional historical perspective and opportunities for interpretation would result from limited grazing at Wawona Meadow and Big Meadow. The use of irrigation would maintain Big Meadow at the large size to which visitors are now accustomed, increasing the variety and interest in distant views of this area.

The use of feeding areas for black bears with provision for safe viewing of the feeding animals would provide opportunities to see these animals under safe, if unnatural, conditions. At the same time personnel would be required to ensure that visitors are not injured by approaching bears too closely or attempting to feed them. The unnatural practice of feeding bears would tend to make visitors think that such practices are acceptable behavior on their part. Also, it would continue the food-reward associations of bears with people, decreasing their fear and continuing the "nuisance bear" population.

The supplemental stocking of lakes with fish would increase the number of lakes available for fishing. This would increase angler success and allow more variety in trips for those wishing to participate in this activity during their visit.

4. Mitigating Measures, Unavoidable Adverse Effects, Short-term Versus Long-term Relationships, and Irreversible or Irretrievable Commitments: The following direct mitigating measures are included in the modifications specified by this alternative.

Where vegetation would be shifted to late successional stages with increased density and unnatural species composition due to fire suppression activities, direct mechanical removal of the understory would be undertaken. Similarly, where areas are too moist for prescribed burning in the period from September to May, or fires burning in this period are of too low an intensity for an effective kill, mechanical removal of the understory would be undertaken to simulate the effects of a fire of the proper intensity.

To insure that backcountry areas with provisions for stock management do not deteriorate through overuse, carrying capacities would be determined and use levels prescribed with due consideration of seasonal variation. Since separation of hikers and riders would sometimes be desired, backpackers could be made aware of trails most frequently being used by riders so that alternate routes might be chosen if preferred.

Adverse visitor use and economic impacts from the use of systemic insecticides, defoliants or biological control of needleminer infestations would be largely mitigated by scheduling treatment in fall. At that time campgrounds would normally be closed or lightly used and business activity a low ebb. Thus visitors and business interests would be minimally affected by control operations. Similarly selection of a fall treatment period would greatly mitigate any possible impact on birds since nesting and rearing of young would be terminated and many nonresident species would have already departed.

Certain unavoidable adverse effects would be created if the modifications of the proposal required by this alternative are implemented. Increased tree felling, line construction, use of mechanical equipment, litter and other routine alterations of the natural environment would result from increased fire suppression. Suppression of naturally occurring fires would reduce the quantity and quality of browse species and adversely affect regeneration of early seral species in forest communities. Exotic plants would persist, and unnatural vegetative communities would be created by vista-clearing. Forage species favored by bears would deteriorate around bear feeding areas. Native wildlife would have habitat disturbance in areas regularly grazed by livestock. Bear population structure and density would be unnaturally altered while a "nuisance" population would be perpetuated. Aquatic communities would continue to be disturbed by interspecific competition and gene pool dilution, while being unable to revert to pristine state as a result of the continuation of stocking. Landscapes would tend to be more uniform due to both the longer period between fires and the results of mechanical removal of understory vegetation. Also, excessive costs would be associated with the mechanical removal program. The exotic golden beaver and bullfrog would probably expand their distribution to all accessible habitats, unnaturally altering and reducing ecosystem integrity by their presence.

While operations associated with control of needleminer infestations would result in some very short-term inconveniences and slight economic opportunity losses, treatment which would preserve tree cover in impacted sites currently incapable of stand replacement would have relatively important, long-range benefits. These are maintenance of shade, screening and aesthetic values of tree cover and elimination of need for abandoning affected areas or relocation elsewhere with all attendant impacts that would result.

In the short-term, the artificial feeding program for bears would provide relief from most bear damage, but over the long-term, would result in the continuation of unnaturally high population levels with intolerable "nuisance problems." The temporary inconvenience created by the smoke from management fires would be greatly reduced during the major visitor use period, but in the long-term, landscapes would be more uniform, vegetation would be altered from its natural state, forage for many forms of wildlife would be reduced and the adverse influences of fire suppression would be unduly effective.

The golden beaver and the bullfrog would probably become naturalized and widely established, degrading the natural environment by their presence. Should this occur, it would constitute an irreversible commitment of resources.

There are several irretrievable commitments of resources. Vegetative conditions would deviate to some degree from the pristine form as a result of increased fire suppression, vista clearing, and the presence of exotic species. High costs associated with mechanical removal of understory vegetation would continue indefinitely. The black bear population would be maintained at an unnaturally high level with dependence on artificial feeding for its survival, while aquatic communities would be kept from adapting to natural conditions or returning to a more pristine form.

IX. CONSULTATION AND COORDINATION WITH OTHERS

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Mr. P. Pister, District Fisheries Biologist, California Department of Fish and Game, Bishop, California.

Forest insect control

Mr. Max Olleoux, Forester, Forest Pest Control Staff, USDA, Forest Service, Region 5, San Francisco, California.

Forest pathology

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Frogs and other amphibians

Dr. P.B. Moyle, Professor of Animal Physiology, University of California, Davis, California.

Dr. R.C. Stebbins, Professor of Zoology, University of California, Berkeley, California.

Lodgepole needleminer

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Review of plan and assessment

Dr. David Hood, Professor of History, California State University, Long Beach, California.

Threatened, endangered and exotic plants

Dr. C.W. Sharsmith, Emeritus Professor of Botany, California State University - San Jose, California.

Wildlife

Mr. Harold Basey, Mother Lode Chapter - Sierra Club, Modesto, California.

Mr. Thomas Beck, Wildlife Biologist, Stanislaus National Forest, Sonora, California.

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Mr. James P. Maddux, Assistant Wildlife Manager - Biologist, California Department of Fish and Game - Region 4, Sonora, California.

Mr. Virgil Mullis, Mariposa Fish and Game Protective Association, Mariposa, California.

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