Environmental Assessment

for the Fire Management Program

Golden Gate
National Recreation Area

March 1992
National Park Service--U.S. Department of Interior

1. PURPOSE AND NEED

There is a continuing need at Golden Gate National Recreation Area to ensure the perpetuation of park ecosystems and natural resources while managing wildland fire to provide for the protection of life, property and cultural resources.

Fire suppression has been performed over the years by well-intentioned stewards of the land. Fire suppression activities have unintentionally deprived the land of what is now understood to be necessary for perpetuation of certain natural ecosystems. As a result, fire adapted communities, such as chaparral and oak woodland, are decreasing. In turn, this is creating a decline in the biological diversity of the park. Many of the park's rare plant species are members of these fire-adapted communities.

The restoration of fire to park ecosystems is an important objective in managing the natural resources of Golden Gate National Recreation Area. The Fire Management Plan is an addendum to the Natural Resources Management Plan. The National Park Service Wildland Fire Management Guideline requires that all areas with vegetation capable of sustaining fire will develop-a fire management plan. Funding for NPS fire management programs is provided by appropriations of the United States Congress on a service-wide basis. The authority for fire management is established in the National Park Service Organic Act which states the following purpose of the agency:

> "to conserve the scenery and the 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."

The NPS Wildland Fire Management Guideline further defines the service-wide goal of wildland fire management:

> "To achieve the resource objectives of the park through prevention of human caused wildfire, to minimize the negative impacts on resources from all wildland fires that occur, and to guide the use of prescribed fire as an integral part of the resources management program in a manner which minimizes the risk to the lives of employees, visitors, neighbors, and to their property."

Golden Gate National Recreation Area's enabling legislation states that the park was founded:

> "In order to preserve for public use and enjoyment certain areas of Marin and San Francisco possessing outstanding natural, historic, scenic and recreational values... "

Further, the act stated that management of the park:

> "shall utilize the resources in a manner which will provide for recreation and educational opportunities consistent with sound principles of land use planning and management."

In addition, the enabling legislation states that:

> "the Secretary shall preserve the recreation area, as far as possible, in its natural setting, and protect it from development and uses which would destroy the scenic beauty and natural character of the area."

The Natural Resources Management Plan for the park reinforces the implementation of a comprehensive fire management program, including:

- Fire suppression
- Prescribed burning
- Fire monitoring
- Fire research

The plan objectives as they pertain to the fire management plan specify that the park will reintroduce the natural "role" of fire into park ecosystems to the maximum extent possible.

Fire Monitoring

A comprehensive approach to prescribed fire is recommended. The results of fuel reduction from fire are clear and easily seen, but the overall ecological effects are complex. Effects vary with intensity, duration, frequency, location, shape and extent of the fire. Other influences are weather conditions, season, nature of fuel, and properties of the site and soil. Due to the many variables, fire is a complex event that can be difficult to understand. In order to better record and understand fire effects all fires will be monitored. Fires will be monitored in accordance with the Western Region Prescribed Fire Monitoring Handbook. The monitoring will document basic information to detect trends and to ensure that fire and resource management objectives are met. From identified trends, staff can articulate concerns, develop hypotheses, and initiate specific research projects to develop solutions to problems.

The main objectives of the monitoring program are to:

- Document basic information for all fires, regardless of management strategy.
- Predict fire behavior and take appropriate action on all fires that:
  1. Have the potential to threaten resources values, or;
  2. Are being managed under specific constraints, such as a prescribed burn.
- Document immediate post-fire effects.
- Follow trends in plant communities where research has already been conducted to establish fire effects in the community.
- Identify problem areas where research needs to be initiated.
- Facilitate the sharing of fire related information by standardizing data collection and analysis techniques.

Prescribed Burning

Golden Gate National Recreation Area is recommending a moderate prescribed burn program consisting of 22 burns totalling 214 acres over the next 5 years. Table 1 and Figure 1 provide a comparison of this program to other Western Region parks prescribed fire programs. The individual units are small and will require one day burning periods.

A great deal of time and money have been dedicated to this program. Personnel have received special training in accordance with National Park Service standards, and prescribed fires have been implemented since 1985. The Western Region Fire Monitoring Program has been established and over 100 monitoring plots have been installed. Control plots have also been installed to isolate the effects of fire from other environmental or human factors.

WESTERN REGION PARK	1992-1996 TOTAL ACREAGE PROPOSED
Sequoia-Kings Canyon National Park	16,200
Santa Monica Mountains National Recreation Area	9,040
Yosemite National Park	8,430
Grand Canyon National Park	8,099
Lava Beds National Monument	2,761
Redwood National Park	1,930
Lassen Volcanic National Park	1,379
Chiricahua National Monument	1,365
Saguaro National Monument	1,277
Pinnacles National Monument	1,042
Point Reyes National Seashore	280
Whiskeytown National Recreation Area	263
Lake Mead National Recreation Area	218
Golden Gate National Recreation Area	214
Joshua Tree National Monument	100

Table 1. Western Region Parks Five Year Burn Plans Total Acreage Proposed, 1992-1996

II. ALTERNATIVES

The following alternatives were analyzed for this environmental assessment. Under each of the alternatives, appropriate suppression response will be taken on all wildfires, including human caused fires, escaped prescribed burns, and any lightning-caused fire.

Alternative A. Full Suppression

Under this alternative all ignitions within Golden Gate National Recreation Area including those of natural origin (lightning-caused) would be suppressed. Suppression would be accomplished through the use of confinement, containment, or control tactics. No prescribed burning or mechanical fuel manipulation would be conducted.

Alternative B. Management Ignited Prescribed Fire (Prescribed Burning) Onlv

Under this alternative management fire, ignited by qualified park personnel, would be used to simulate the ecological effects of natural fire, and to reduce hazard fuels. Management ignited prescribed fire would be used throughout Golden Gate National Recreation Area. These fires would be intentionally ignited to accomplish management objectives in specific areas under prescribed conditions identified in approved prescribed burn plans. Prescriptions for these burns would allow intensities to be sufficient to accomplish the desired results for management purposes. All other ignitions (whether of natural or human origin) would be suppressed. All fires would be monitored and possible research projects may be involved. Mechanical manipulation would not be used.

Alternative C. Full Mechanical Manipulation (Only)

Under this alternative hazard fuel buildups would be removed or manipulated strictly by mechanical means to the extent practicable. Prescribed burning would not take place and all wildfires would be suppressed. Mechanical means would be used to simulate the ecological effects of fire such as the reduction of stand densities and the encroachment of fire intolerant species.

Alternative D. Management Ignited Prescribed Fire and Mechanical Manipulation (PROPOSED ALTERNATIVE)

This alternative is a combination of Alternatives B and C. Management ignited prescribed fire would primarily be used to gain the missing ecological benefit of natural fire, and mechanical manipulation would be used primarily to reduce hazardous accumulations of vegetation. All fire would be monitored and research projects may be involved with specific burns.

Alternatives Considered but Rejected:

1. No action

Under this alternative all ignitions would be allowed to burn in all areas and at all times.
This alternative was rejected due to the unacceptable risk to human life and property,
with significant political, socioeconomic and environmental impacts.

2. Prescribed Natural Fire Program

Under this alternative natural (lightning-caused) ignitions would be managed in

predetermined areas if all prescription criteria are met. This alternative was rejected due

to:

* the relatively small size of continuous wild lands.
* the degree of private ownership and property development in and around surrounding park lands.

III. AFFECTED ENVIRONMENT

A. Description of the Recreation Area

Golden Gate National Recreation Area is comprised of approximately 75,000 acres of coastal lands in the San Francisco Bay area. The northern area is in Marin County and is part of a large greenbelt which includes Point Reyes National Seashore, Mount Tamalpais State Park, Marin Municipal Water District and several private organizations. The southern area is in San Francisco and San Mateo Counties and is part of a large greenbelt including the San Francisco Watershed and several San Mateo County Parks.

There are six major vegetation types defined within the Recreation Area:

- Grassland and coastal scrub
- Broadleaf evergreen forest
- Chaparral
- Old-growth redwood
- Second-growth redwood and Douglas fir
- Eucalyptus/other exotics

The topographical relief of the ranges within Golden Gate National Recreation Area range from sea level to 2300 feet above mean sea level. Slopes range from flat marine terraces and alluvial deposits to steep canyons along some creeks.

The Mediterranean climate of Golden Gate National Recreation Area is considered a fire climate. Many plants in this climate are adapted to fire, and in the absence of fire fuels can build up to hazardous proportions. Temperature and wind speed vary with elevation, season, aspect and amount of vegetative cover. Winds are generally from the west with less frequent southwesterly winds associated with storm passage. Average winter temperatures range from 48-53°F with minimums from 45-50°F. Summer average temperatures range from 55-65°F with maximums of 64-70 ° F.

B. Adjacent Landowners and Agencies

Golden Gate National Recreation Area is bordered by Federal, State, County, city and private lands. The adjacent Federal lands are administered by the National Park Service and the Department of Defense, United States Army. The State lands are administered by the California Department of Parks and Recreation. The County lands are administered by Marin Municipal Water District and San Francisco Water Department. City lands include Pacifica, San Francisco, Sausalito, Marin City, Mill Valley, Olema and Point Reyes Station. There are numerous private lands along the boundary.

The other National Park Service administered area, Point Reyes National Seashore, manages wildland fire with a program of suppression, management ignited fire and mechanical fuel reduction. The management ignited fire is used to reduce hazard fuels, exotic plant control, wildlife habitat management, and agricultural applications. Any natural fire would be managed under a suppression strategy of confine, contain, and control.

United States Army lands are administered under a full suppression strategy.

The lands administered by the California Department of Parks and Recreation are managed under a suppression, prescribed burning and mechanical fuel reduction program. All natural fires are suppressed.

The Marin Municipal Water District lands are currently being managed under a full suppression strategy pending the completion of a new vegetation management plan. The plan will address all forms of fire and fuels management including, but not limited to, mechanical and prescribed burning.

The San Francisco Water Department Lands are managed under a suppression, prescribed fire and mechanical fuel reduction program. They are currently updating their management plan.

All other city and private lands are managed under a full suppression strategy with mechanical reduction for structural protection.

C. Vegetation

Golden Gate National Recreation Area is located on the edge of two floristic provinces:

1) the Californian, characteristic of the southern California landscape, which includes dry ecosystems; and,
2) the Oregonian, which is associated with the wetter ecosystems of the Pacific Northwest.

Golden Gate has components of both floristic provinces. In addition, the varied geology creates many soil types on which a variety of plants have adapted. These and other physical and biological factors have led to a wide diversity of plants, which can be found in the following major plant communities:

1. Grassland and Coastal Scrub

The grassland community at Golden Gate National Recreation Area extends from sea level to nearly 2600 feet. It forms a mosaic with the coastal scrub community and mixed evergreen forests.

A more complete description of this plant community is found on pages 20-23 of the Fire Management Plan.

Pristine coastal grassland was composed of native perennial grasses and is now threatened by exotic plant invasion. Evidence suggests that at least some native perennial grasses are adapted to fall burning.

The prescribed fire program in the grassland /coastal scrub community consists of small prescribed burns (1-35 acres). The objective of these burns is to monitor the fire behavior and effects to verify the perpetuation of native species, reduce invading species and reduce fuel when appropriate. Prescriptions for each

objective exist and are continually being refined.

2. Broadleaf Evergreen Forest

This variable community extends from 200 to 2500 feet in elevation, and is dominated by oak *(Quercus spp.),* California bay *(Umbellularia californica)* and/or tanbark oak *(Lithocarpus densiflorus).* Along the mesic boundary of this mixed evergreen forest is the redwood/Douglas fir community and along the xeric boundary is the coastal scrub and grasslands.

Coast live oak *(Quercus agrifolia)* dominates this community at elevations below 1000 feet. It is often the only species present on hills frequented by a cool foggy coastal climate. Interior live oak *(Quercus wislizenia)* sometimes replaces coast live oak in canyon bottoms and north-facing slopes. As the community approaches 1000 feet in elevation, California bay *(Umbellulatia californica)* and other hardwoods become common.

A more complete description of this plant community is found on pages 23-24 of the Fire Management Plan.

The broadleaf evergreen forest has many fire resistant properties and many species sprout. Prescribed burns will determine fire effects on the community and help management to develop and refine prescriptions. Management fires will then mimic the fire behavior and frequency traits which will best preserve the ecology of these species.

3. Chaparral

Chaparral is not in abundance at Golden Gate National Recreation Area. Small communities exist in Muir Woods and the Marin Headlands, as well as a larger area on Bolinas Ridge. There are several types of chaparral in Golden Gate National Recreation Area:

- Chamise Chaparral, dominated by chamise *(Adenostoma fasciculatum) is* characteristically found in hot, dry areas usually on south and west-facing slopes and ridges.
- Ceanothus Chaparral is often dominated by a single species of ceanothus *(Ceanotlius spp.)* and occurs on moister sites than chamise chaparral.
- Manzanita chaparral is dominated by species of manzanita *(Arctostaphylos* spp.) and usually occurs on deeper soils or on ridge lines and is generally not as extensive as the previous chaparral types.
- Serpentine Chaparral is a low, open community associated with serpentine soils.

- Mixed Chaparral is where the first three types intergrade.

A more complete description of this plant community is found on pages 24-27 of the Fire Management Plan.

Chaparral is a fire adapted community that has been the subject of much study. The health of community diversity depends on fire. Without fire the community grows more flammable as more of the canopy becomes decadent. Prescribed fire will be used to reduce fuel loadings and to restore the natural role of fire to the community.

4. Old-Growth Redwood

Many species contribute to this ecosystem. Major over and under- story trees include coast redwood *(Sequoia sempervirens),* Douglas fir *(Pseudotsuga menziesii),* California bay laurel *(Umbellularia californica),* tanbark oak *(Lithocaipus densiflorus),* California hazel (Coiylus *californica),* and madrone *(Arbutus menziesii).*

A more complete description of this plant community is found on pages 27-31 of the Fire Management Plan.

The fuel buildups in Muir Woods currently present a hazard to neighboring communities and to the woods themselves, elimination of fire from this environment will perpetually increase this hazard. Prescribed fire has been initiated to reduce fuel loadings as well as restore the natural role of fire to this community. Fire will continue to be used and closely monitored.

5. Second Growth Redwood and Douglas Fir

Douglas fir communities are found on Bolinas Ridge and within Muir Woods. The communities on Bolinas Ridge have been logged. Douglas fir in Muir Woods sites have brush understory and a significant component of dead fuel.

A more complete description of this plant community is found on pages 31-33 of the Fire Management Plan.

Fuel loadings are increasing in this community and need reduction on both the slopes of Muir Woods and Bolinas Ridge. Prescribed fire will reduce the fire hazard by reducing fuel loadings and restoring the natural role of fire into the community.

6. Eucalyptus/Other Exotics

Many vegetative species have been introduced into Golden Gate National

Recreation Area as ornamentals, wind breaks, or for shade or pasture. Many of

these exotics have escaped cultivation and are invading native communities.

Several stands of blue gum (*Eucalyptus globulus*) are found in Golden Gate National Recreation Area. The stands typically occur near former ranch lands and along park boundaries, usually planted as windbreaks. Since the trees were established in the mid 1800's, two problems have developed: (1) the build up of flammable fuels in proximity to urban areas and (2) the encroachment of the eucalyptus on native plant communities.

A more complete description of this plant community is found on pages 33-35 of the Fire Management Plan.

Blue gum has caused an extreme fire hazard in Golden Gate National Recreation Area due to the nature of fuels beneath it. It is also invading native communities. Literature indicates that the species is adapted to intense fire but that low-intensity fire adversely effects regeneration. Prescribed fire will be used to contain populations and reduce fire.

D. Fuels

In order to understand the environmental consequences and impact analysis of this assessment, some explanation of fuels is necessary. Golden Gate National Recreation Area has a history of both~natural fire and Native American ignited fires. Wildfires have been suppressed for the last 100 years. This suppression strategy, along with decreased grazing and the introduction of exotic plants, resulted in a large accumulation of fuels. These fuel accumulations increase the potential for high intensity fires which are more difficult to suppress. Human influences have also caused a change in vegetative structure from native species to introduced European grasses and other exotics. This change has contributed to a more volatile fire condition.

E. Wildlife

Golden Gate's diverse plant communities support a rich assemblage of wildlife. A total of 507 vertebrate species are likely to occur within or adjacent to park boundaries. Provisional counts list 14 amphibians, 22 reptiles, 369 birds, and 102 mammals. Standard reference texts are available for mammals, birds, reptiles and amphibians in the Recreation Area.

Fire is an important element in the life processes of many species. Fire can be beneficial when it establishes maximum "edge" within a vegetative, community. This "edge effect" can create conditions favorable for feeding, nesting, restinf, and cover. A mosaic of climax and seral vegetative communities can be a critical component of wildlife habitat. Diversity in plant species which can be obtained by fire allows for diet diversity for wildlife. Additional burning may be beneficial in increasing the nutritional quality of browse and forage.

F. Rare, Endangered, or Threatened Species

The mandate of the National Park Service, and Golden Gate National Recreation Area, is to preserve and protect natural and cultural resources. The National Park Service will therefore demand strict compliance with the Threatened and Endangered Species Act and will manage all proposed species to the official list created by the act as if they had been granted official endangered status.

The coastal region managed by Golden Gate National Recreation Area provides habitat for a large number of plant and animal species which have been designated or nominated for threatened or endangered status by state or federal agencies. The primary reasons for the large number of endangered species within a small area such as Golden Gate National Recreation Area are rapid and widespread habitat loss, and speciation of certain plants and animals as a result of genetic isolation. Prescribed fire and suppression are management strategies that effect habitat loss. Fire can be used to maintain several key habitat seral stages, while suppression of all fires will maintain fewer seral stages.

The majority of the rare, threatened and endangered plants of Golden Gate National Recreation Area occur on serpentine soils, rock outcrops and coastal bluffs. The park's endangered plant list is taken from the California Native Plant Society (Table 2). Rare, threatened and endangered animals within Golden Gate National Recreation Area have been listed by both the state and federal governments (Table 3). Fish and Wildlife and/or the Department of Fish and Game will be consulted on all burns that may affect an endangered or threatened species.

Table 2. Rare Plants of Golden Gate National Recreation Area. California

Species Name	Common Name	Status*
Acanthomintha obovata duttonii	San Mateo thornmint	F
Arabis blepharophylla	Coast rock cress	C
Aretostaphylos hookeri ravenii	Raven's manzanita	F
Arctostaphylos montana	Tamalpais manzanita	C
Arctostaphylos virgata	Bolinas manzanita	C
Calamagrostis nutkaensis	Pacific reedgrass	C
Calochortus umbellatus	lily	C
Ceanothus masonii	Mason's California-lilac	S
Cirsium andrewsii	Franciscan thistle	C
Clarkia franciscana	Presidio clarkia	S
Cordylanthus maritinsus palustris	Salt marsh bird's-beak	C
Dirca occidentalis	Western leatherwood	C
Elymus californica	California bottlebrush grass	C
Eriogonum caninum	Tiburon buckwheat	C
Erysimum franciscanum franciscanum	San Francisco wallflower	C
Fritillaria liliacea	lily	C
Grindelia maritima	San Francisco gumplant	C
Hemizonia multicaulis	tarweed	C
Hesperolinon eongestum	Marin dwarf-flax	C
Lessingia germanorum germanorum	San Francisco lessingia	S
Microseris decipiens	Santa Cruz microseris	C
Orthoearpus floribundus	San Francisco owl's clover	C
Perideridia gairdneri	Squaw potato	C
Plagiobothrys diffusis	San Francisco popcorn flower	C
Silene verecunda verecunda	Dolores campion	C
Streptanthus glandulosa pulchellus	Tamalpais jewel flower	C
Tanacetum camphoratum	Dune tansy	C
Trifolium amoenum	*Showy* Indian clover	C

* F - Federal listed endangered
* S - State listed endangered
* C - candidate for federal listing

Table 3. Species which occur at Golden Gate National Recreation Area that have been proclaimed rare, threatened or endangered by State and/or Federal Agencies. These species are in need of special management and protection provisions.

Common Name	Species Name	Status	Agency
REPTILES			
San Francisco Garter Snake	*7hamnophis sirtalis tetrataenia*	E	F
AVES			
Brown Pelican	*Pelecanus occidentalis*	E	F&S
Southern Bald Eagle	*Haliaeetus leucocephalus leucocephalus*	E	F&S
American Peregrine Falcon	*Falco peregrinus anatum*	E	F&S
Northern Spotted Owl	*Strix occidentalis caurina*	T	F
Bank Swallow	*Riparia riparia*	*T*	*S*
Salt Marsh Yellowthroat	*Geothlypis trichas sinuosa*	*C*	*F*
Tri-Colored Blackbird	*Agelaius tricolor*	*C*	F
Northern Harrier	*Circus cyaneus*	*SC*	*S*
Osprey	*Pandion haliaeetus*	*SC*	*S*
Burrowing Owl	*Speotyto cunicularia*	*SC*	*S*
MAMMALS			
Townsend's Big-Eared Bat	*Plecotus townsendii*	*C*	F
FISH			
Tidewater *Goby*	*Eucyclogobius newberryi*	*C*	F
CRUSTACEA			
California Freshwater Shrimp	*Syncaris pacifica*	E	S
INSECTS			
Mission Blue Butterfly	*Plebejus icariodes missionensis*	E	F
San Bruno Elfin	*Callophrys mossi bayensis*	E	F
Bay Area Checkerspot	*Euphydryas editha bayensis*	E	F
San Francisco Forktail Damselfly	*Ischnura gemina*	*C*	F

E = endangered
F = Federal designation
S = State of California designation
C = candidate
T = threatened
SC = species of concern

Species which MAY occur at Golden Gate National Recreation Area that have been proclaimed rare, threatened or endangered by State and/or Federal Agencies. These species are in need of special management and protection provisions.

Common Name	Species Name	Status	Agency
AVES			
California Clapper Rail	*Rallus longirostris obsoletus*	*E*	F&S
Black Rail	*Laterallus jamaicensis*	*C*	*F&S*
California Least Tern	*Sterna albifrons browni*	*E*	*F&S*
Western Snowy Plover	*Charadrius alexandrius*	*C&SC*	*F&S*
Long-Billed Curlew	*Numenius arnericanus*	*C*	*F*
Common Loon	*Gavia immer*	*SC*	*S*
American White Pelican	*Pelicanus erythrorhynchos*	*SC*	*S*
Barrow's Goldeneye	*Bucephala islandica*	*SC*	*S*
MAMMALS			
Salt-marsh Harvest Mouse	*Reithrodontomys raviventris raviventris*	*E*	*F&S*
Gray Whale	*Eschrichtius glaucus*	*E*	*F*
Southern Sea Otter	*Enhudra lutris nereis*	T	F
INSECTS			
Globose Dune Beetle	*Coleus globus*	*C*	F
Rickseckers Water Scavenger Beetle	*Hydrochara rickseckeri*	*C*	F
Myrtle's Fritillary	*Speyeria zerene myrtrleae*	*C*	F

E = endangered
F = Federal designation
S = State of California designation
C = candidate
T = threatened
SC = species of concern

G. Air Quality

Air quality within Golden Gate National Recreation Area is fairly good, considering the park's proximity to an urban area. Incoming offshore winds generally keep the air in good condition. Aeiometric and meteorological data are collected by the Bay Area Air Quality Management District (BAAQMD). They have 29 sites in the greater Bay Area, two of which are in San Francisco, and one which is in San Rafael. In addition, the BAAQMD monitors air quality in a tower network on 28 different Bay Area sites. One of these sites is at Fort Funston in Golden Gate National Recreation Area and a second is on Mt. Tamalpais. As a result, the Recreation Area has access to air quality data within and near the park.

H. Water Resources

The Aquatic/Water Resources Management Plan provides a complete description of the water resources within Golden Gate National Recreation Area. The varied water resources of the park include groundwater (springs), freshwater (streams and ponds), salt water (the Pacific Ocean and San Francisco Bay), transitional areas (brackish lagoons), and seasonal wetlands. Seven significant watersheds are located with the park. They are, from north to south, Lagunitas Creek, Olema Creek, Redwood Creek, Elk Creek, Rodeo Creek, Lobos Creek, and the San Francisco Watershed lands in San Mateo County.

There are many uses of water in Golden Gate National Recreation Area. These are documented by the Bay Area Water Resources Control Board, and include: municipal water supply, agricultural supply, fresh water replenishment, recreation, commercial and sport ocean fishing, warm and cold fresh water habitat, terrestrial habitat, the preservation of rare and endangered species, fish migration and fish spawning, and shellfish harvesting.

I. Soils

The soils occurring in Golden Gate National Recreation Area can be divided into three general kinds of landscape groups. These three groups are listed below along with the predominant soil association or variant that occurs in each group on Golden Gate lands.

1. Soils on Alluvial Fans and Plains, in Basins, and on Tidal Flats

- Blucher-Cole: Very deep, gently sloping, somewhat poorly drained soils; in basins and on alluvial fans.
- Xerorthents-Urban land: Deep, nearly level to sloping soils, and urban lands; on alluvial fans, alluvial plains, and tidal flats.

2. Coastal Soils on Dunes, Terraces, Hills. Mountains, and Uplands

- Cronkhite-Dipsea-Centissima: Moderately deep and deep, strongly sloping to very steep, moderately well drained and well drained soils

underlain by sandstone and shale; on uplands.

- Tamalpais-Barnabe Variant: Shallow and moderately deep, moderately steep to very steep, well drained soils underlain by chert and sandstone; on uplands.
- Olompali-Soulajule-Felton Variant: Moderately deep and deep, gently sloping to very steep, somewhat poorly drained to well drained soils; on terraces and uplands.

3. Inland Soils on Uplands

- Tocaloma-Saurin: Moderately steep, gently sloping to very steep, well drained soils underlain by sandstone and shale; on uplands.
- Maymen-Maymen Variant: Shallow and moderately deep, steep and very steep, somewhat excessively drained and well drained soils underlain by sandstone and shale; on uplands.
- Tocaloma-McMullin-Urban land: Moderately deep and shallow, well drained, moderately steep to very steep soils underlain by sandstone and shale, and Urban land; on uplands.

J. Cultural Resources

The prehistoric, historic and contemporary Native American cultural resources of Golden Gate National Recreation Area cover a time span of at least 2,000, and perhaps 6,000 years; although discontinuously.

1. Prehistoric

Evidence of Native Americans in Golden Gate National Recreation Area ranges from shell midden sites to Alcatraz graffiti. Six Miwok archeological sites occur in the Marin County area of Golden Gate National Recreation Area.

Costanoan and Miwok cultures occupied the lands of Golden Gate National Recreation Area. The Costanoan burned extensive areas each fall to promote growth of seed bearing annuals, increase available grazing areas and facilitate the gathering of acorns. Although information on the Coast Miwok burning practices are scant, it is known that the inland Miwok burned the land each August after seed gathering from May to August. The Bear Valley fire chronology suggests that the Coast Miwok burned the land more frequently than did lightning ignited fires.

2. Historic

The historic resources represent the major stages of regional land use and economic history over the last 200 years. There are nearly 800 historic sites and structures within the park boundary which include: a prison, a lighthouse, old ranch houses, and military fortifications.

Properties listed on the National Register of Historic Places include:

* Forts Baker, Barry and Cronkhite
* The Presidio
* Fort Mason Historic District
* Fort Point Historic Site
* Point Lobos Archeological Sites

The archeological survey for San Mateo County lands is not complete. Protection of Golden Gate National Recreation Area archeological, cultural and historic resources is a park priority.

IV. CONSEQUENCES OF THE PROPOSED ACTION AND ALTERNATIVE ACTIONS

A. Vegetation

Alternative A: Full Suppression

Under this alternative unnatural vegetation patterns would occur due to the removal of fire from the ecosystem. Many species as well as the health of ecosystems depend on fire. Fire dependent plant communities and their associated threatened and endangered species would disappear. Higher intensity fires would occur. Suppression activities would result in adverse resource impacts from firelines, helispot construction and other activities.

A goal of achieving effective suppression on every fire may be impractical, and occasional ecological benefits (as described under Alternatives B, C and D) may be realized from fires which burn significant acreage before they are suppressed.

Alternative B: Management Ignited Prescribed Fire (Prescribed Burning) Only

The effects on vegetation depend on fire behavior and the type of vegetation involved. Variations in tire intensity, temperature, flame length, duration, time of day and season will influence the impact of fire.

Fire may kill or damage individual plants or plant species but many plants will survive through various fire adaptations. Individuals of some species are inherently more resistant to fire and therefore survival rates differ. The effect of fire on individual communities is discussed in the fire management unit section of the fire management plan.

Prescribed burns *would* prevent catastrophic damage to fire tolerant species and would reduce fuel accumulations that could contribute to large and potentially dangerous conflagrations. Impacts resulting from suppression of natural ignitions *would* be similar to those described in Alternative A.

Hazard fuel reduction burns near park boundaries are often conducted during the season of the year best suited to control efforts. Burning at these times of year can increase the mortality rate of some plants that are fire adapted. Thus hazard fuel burning, in some instances, can reduce the biodiversity of an area.

Alternative C: **Full Mechanical Manipulation (Only)**

This alternative would have a high residual effect on vegetation. Vegetation would be impacted by the movement of materials (by dragging the vegetation or by moving vehicles transporting the material to hauling areas). There would be a net loss of nutrients, due to the removal of biomass.

Alternative D: Management Ignited Prescribed Fire and Mechanical Manipulation (PROPOSED ALTERNATIVE)

This alternative is a combination of Alternatives B and C, providing the more positive elements, and minimizing the negative impacts of each alternative. These management tools would only be used in areas ideally suited for management by prescribed burning or mechanical manipulation.

B. Fuels

Alternative A: Full Suppression

Implementing this alternative would create a gradual and unnatural increase in fuel accumulations leading to increased potential of wildfires of greater size and intensities that would occur under natural fire regimes. Control capabilities would be compromised or exceeded, and suppression expenses increased. The potential of threat to life and property also rises. Under full suppression there is an increased potential for large destructive fires.

Alternative B: Management Ignited Prescribed Fire (Prescribed Burning) Only

Prescribed burning would reduce accumulations of fuels which contribute to large and potentially catastrophic fires. Prescribed burning for fuel modification in areas near structures and high value areas, is potentially dangerous if a fire escapes control lines.

Alternative C: Full Mechanical Manipulation (Only)

This alternative is very expensive and has unsatisfactory residual effects on the natural environment. Fuels require cyclic maintenance in order to maintain conditions at an acceptable level.

Alternative D: Management Ignited Prescribed Fire and Mechanical Manipulation (PROPOSED *ALTERNATIVE)*

The combination of prescribed burning and mechanical fuel manipulation would allow the reduction of fuels that, if not reduced, would contribute to large, potentially catastrophic fires. Mechanical manipulation would allow for fuel reduction adjacent to structures or high value areas. Prescribed burning would allow for fuel modification in larger areas away from structures and high value areas.

C. **Wildlife**

Alternative A: Full Suppression

Wildlife populations would be influenced directly and indirectly by the impacts on associated vegetative communities. The increased probability of intense wildfires would lead to fire caused mortalities. The potential for inadvertent wildlife habitat destruction could occur from fire suppression activities such as fireline construction and utilization of natural water sources, as well as loss of successional stages for habitat.

Alternative B: Management Ignited Prescribed Fire (Prescribed Burning) Only

Given the constraints placed on prescribed burning, this alternative would allow greater flexibility in planning for, locating, and avoiding disturbance to wildlife populations. Habitat impacts would be determined by prescribed burn timing, location, conditions and patterns. With prescribed burns, conditions favorable to fire-dependent species would be created but not in the manner associated with natural ignitions. The distribution of habitat would be less natural and determined by timing, locations, conditions, and patterns of prescribed burns as compared to natural fires. Impacts resulting from suppression would be similar to those described in alternative A.

Alternative C: Full Mechanical Manipulation (Only)

This alternative does not produce the sprouting, nutrient release and mosaic that provides for a healthy wildlife habitat. The impacts from mechanical manipulation have an unsatisfactory residual effect on the natural environment.

Alternative D: Management Ignited Prescribed Fire and Mechanical Manipulation (PROPOSED ALTERNATIVE)

This alternative is a combination of alternatives B and C, providing the more positive elements, and minimizing the negative impacts of each alternative. These management tools would only be used in areas ideally suited for management by prescribed burning or mechanical manipulation.

D. Rare, Endangered, or Threatened Species

Alternative A: Full Suppression

Populations of fire dependent species which are already rare due to previous fire suppression activities may be further reduced due to lack of fire or high intensity fire. Other sensitive habitats for both plant and animal species could be destroyed through catastrophic fire. Fire suppression activities may further damage habitat.

Alternative B: Management Ignited Prescribed Fire (Prescribed Burning) Only

Potential impacts on all sensitive species will be taken into consideration when planning prescribed burns. With the scheduled nature of activities under this alternative, there is a greater ability to plan, locate and avoid disturbance of these populations due either to ignition or fire control activities.

Alternative C: Full Mechanical Manipulation (Only)

This alternative creates an unsatisfactory residual effect. It also does not produce the needed effects on tire dependent species.

Alternative D: Management Ignited Prescribed Fire and Mechanical Manipulation **(PROPOSED ALTERNATIVE)**

This alternative allows for the mechanical manipulation for protection of selected species as well as the benefits of fire on tire dependent species.

E. **Air Quality**

Alternative A: Full Suppression

Implementation of this alternative would generate a short term reduction of particulate matter from fires due to suppression efforts. The type and amount of emissions would vary greatly dependent upon fuel moisture, fire intensity and other physical characteristics of the environment. This alternative would increase the potential for severe episodes of air pollution due to the accumulated fuels resulting from suppression actions. The potential for large, high intensity fires which are difficult to suppress would continue to increase, further contributing to uncontrolled and undesirable impacts to air quality and visibility.

Alternative B: Management Ignited Prescribed Fire (Prescribed Burning) Only

Local air quality will be effected for short periods of time during prescribed burns, with air quality returning to normal following the completion of burning. Particulate matter will be the primary pollutant with localized effects, therefore no significant long term health impacts are expected. The effect of particulate matter and visibility on local communities can be lessened by the proper use of smoke management and public notification. The controlled nature of these burns makes their effect on air quality less severe than for prescribed natural fire or catastrophic wildfire. -

Alternative C: Full Mechanical Manipulation (Only)

Under this alternative air quality would be effected by vehicle emissions and other petroleum powered equipment being used during the project. This impact would be short-lived and present only during the individual project implementation.

Alternative D: Management Ignited Prescribed Fire and Mechanical Manipulation (PROPOSED ALTERNATIVE)

The impact on air quality under this alternative would essentially be a combination of Alternatives B and C. The proposed prescribed fires are small in size which will minimize the effects on air quality. Fires conducted in the Recreation Area are coordinated with the Bay Area Air Quality Management District. Smoke production is minimal due to the size of the burns and the conditions under which they are burned.

F. Water Resources

Alternative A: Full Suppression

Allowing for increasing biomass development and maintaining undisturbed vegetative cover would tend to reduce water yields. Water quality due to reduced siltation would remain positive and erosion rates would be stabilized or reduced. The increased potential for large catastrophic fire would increase periods of unnatural soil erosion, surface run off and turbidity, adversely impacting water quality. Following a high-intensity fire, surface runoff may increase as much as eight times the normal rate due to vegetative removal, reduction of forest floor litter and duff, and reduced soil infiltration rates from lignin and waxeous material. Erosion potential would result from fireline construction and other ground disturbances associated with suppression activities. Aquatic habitat may be impacted by increased sediment. Implementation of this alternative would result in the highest potential impact on water resources.

Alternative B: Management Ignited Prescribed Fire (Prescribed Burning) Only

Because of the controlled area, timing, and intensity of prescribed burning, there should be only temporary impacts on water quality in a localized area. Prescribed burns could be designed to minimize the effects on downstream water quality where necessary. Vegetation removed by prescribed tire would reduce water consumption providing additional soil moisture later in the season. This would also provide increased spring water flow for wildlife use.

Alternative C: Full Mechanical Manipulation (Only)

Under this alternative residual water impacts due to soil compaction will occur. Erosion potential will increase along with possible surface run-off and turbidity, adversely impacting water quality.

Alternative D: Management Ignited Prescribed Fire and Mechanical Manipulation (PROPOSED ALTERNATIVE)

The impact on water resources under this alternative would essentially be the same as Alternative B. In addition, this alternative would allow for mechanical protection of selected areas (lowering the likelihood of a catastrophic fire), as well as providing the benefits of prescribed tire.

G. Soils

Alternative A: Full Suppression

Long-term impacts of this alternative, with increased potential for catastrophic fire, indicate possible adverse impacts to soils. The diurnal temperature regime would be altered from the effects of catastrophic fire due to loss of shading and insulating cover. Sterilization of soil may occur and algal biomass that aids in soil stability may be adversely impacted. Fire suppression activities may severely impact soils during episodes of catastrophic fire. Some erosive effects would result from the construction of firelines and other ground disturbing activities.

Alternative B: Management Ignited Prescribed Fire (Prescribed Burning) Only

Because of the controlled area, timing, and intensity of prescribed burning in this alternative, there should be little or no long or short term changes in soils within prescribed burn areas. Some erosive effects would result from the construction of (relines and other ground disturbing activities. Firelines created as a result of burn activities would be rehabilitated to minimize erosion.

Only small amounts of vegetative cover are lost from prescribed burns. Areas that are burned are young, green and resistant to burning, thus protecting soil in these areas. Burning is often patchy which prevents soils in these areas from sheet erosion as well as increasing interception of precipitation.

Alternative C: Full Mechanical Manipulation (Only)

Under this alternative soil would be impacted due to the use of project equipment and the potential for soil erosion would increase.

Alternative D: Management Ignited Prescribed Fire and Mechanical Manipulation (PROPOSED ALTERNATIVE)

The combination of using mechanical fuel manipulation to reduce hazard fuel build-ups along with management ignited prescribed burns reduces fire intensity. This reduces the negative effects associated with the extreme temperatures generated during wildfires. Temperatures from prescribed fires are low in comparison to wildfires (approximately 600°F at the soil surface during prescribed burns as compared to 1500-2000°F on wildfires). These lower temperatures will lower losses of nitrogen and other organic soil nutrients, leaving more available nutrients in the post-fire environment.

H. Cultural Resources

Alternative A: Full Suppression

Recorded cultural resources would receive protection from wildfire under this alternative. Potential for cultural resource damage by fire would increase in the long-term scenario. This would occur where high-intensity fire, beyond the ability of conventional fire suppression resources to control, may require heavy equipment to suppress. There would be an increased possibility of destruction to previously unrecorded cultural resources as a result of fire suppression activities. The probability of high-intensity wildfire (resulting from suppression efforts burning over sites and causing severe damage) is increased. High-intensity fires may impact archeological sites through discoloration of surface artifacts, burning vegetative and perishable materials and cracking of rock or ceramic artifacts.

Alternative B: Management Ignited Prescribed Fire (Prescribed Burning) Only

With the scheduled nature of burning under this alternative, there is an ability to plan for, locate, and avoid the disturbance of cultural resources due to either ignition or fire control activities. Also, dangerous fuel buildups in the vicinity of known cultural resources would be reduced, further enhancing the protection of these resources from wildfires.

Alternative C: Full Mechanical Manipulation (Only)

Mechanical fuel reduction can be used to reduce hazardous fuel buildups around cultural resources, thus further enhancing the protection of these resources from wildfires.

Alternative D: Management Ignited Prescribed Fire and Mechanical Manipulation (PROPOSED ALTERNATIVE)

The impact on cultural resources under this alternative is essentially the same as Alternative B. In addition, however, mechanical fuel reduction can be used around areas that might be damaged by wildfires, enhancing the protection of these resources.

I. Safety

Alternative A: Full Suppression

The,occurrence of catastrophic fires resulting from high fuel loadings caused by fire suppression would pose a threat to the safety of both firefighters and the public. Efforts at direct attack or suppression of severe fires would also pose a threat to firefighter safety due to the nature of such activity. Examples of this are fireline construction, cutting down trees, helicopter transport, backfire operations and exposure to smoke.

Alternative B: Management Ignited Prescribed Fire (Prescribed Burning) Only

The implementation of prescribed burning allows fireline construction to be accomplished in a safe manner due to the ability to schedule such activities and to plan their construction in an orderly fashion. Fires are ignited in a preplanned pattern and generally are of low intensity. There is a potential safety problem from prescribed fires that may escape control lines.

Alternative C: Full Mechanical Manipulation (Only)

This alternative would increase the potential for safety problems due to the use of equipment such as chainsaws, chippers and other powered equipment and vehicles.

Alternative D: Management Ignited Prescribed Fire and Mechanical Manipulation (PROPOSED ALTERNATIVE)

This alternative would allow for the benefits identified in Alternative B along with the ability to use mechanical means to provide pre-burning conditions that would protect personnel and structures in the area.

J. Economic

Alternative A: Full Suppression

In the short-term, suppression of potentially damaging fires would reduce economic loss. However, this program would be costly to implement. Over the long-term, the potential for catastrophic fires would increase, possibly causing economic disruption from loss of natural resources and deterioration of the visitor experience. There would be impacts on the local economy due to the employment of fire suppression personnel. As the fire hazard increases due to the continuing buildup of fuels, the magnitude of the suppression effort would rise as would associated costs. There would be a potential for the direct loss of capital improvements as a result of catastrophic fire events.

Alternative B: Management Ignited Prescribed Fire (Prescribed Burning) Only

Prescribed burning would reduce hazard fuel accumulations around structures and other improved properties. This would reduce potential economic loss from catastrophic fires. There is a potential loss from prescribed fires that may escape control lines. Additionally, prescribed burning is a highly cost effective land management tool.

Alternative C: Full Mechanical Manipulation (Only)

This alternative would be the most expensive approach to vegetation manipulation. The costs associated with necessary labor and equipment are intensive.

Alternative D: Management Ignited Prescribed Fire and Mechanical Manipulation (PROPOSED ALTERNATIVE)

In addition to the economic impacts listed in Alternative B, mechanical manipulation of fuels would also help to reduce hazard fuel buildups. This would help in reducing the potential for economic losses due to catastrophic fires.

K. Visual or Aesthetic Values

Alternative A: Full Suppression

Implementing this alternative would reduce the short-term visual effects (charring of bark and scorching of foliage) that would result from other alternatives utilizing prescribed fire. However, the increased potential for high-intensity fire that would develop over the long run would result in drastic changes in the aesthetic appearance of affected areas. Some unsightly activities (i.e., firelines, stumps, etc.) may result, even under carefully conducted suppression operations.

Alternative B: Management Ignited Prescribed Fire (Prescribed Burning) Only

Through the use of prescribed burns, areas with sensitive visual resources can be protected from fire and certain fire suppression activities, or burned with lower-intensity fire, resulting in minimal changes to aesthetics. Some firelines would be cut and maintained to define burn units. Short-term visual effects would consist of charring of bark and scorching of foliage.

Alternative C: Full Mechanical Manipulation (Only)

This alternative would impact visual resources due to equipment use and the removal of vegetation. This would include impacts to accessing trails and roads.

Alternative D: Management Ignited Prescribed Fire and Mechanical Manipulation (PROPOSED ALTERNATIVE)

The impact on visual or aesthetic values under this alternative is essentially a combination of Alternatives B and C.

L. Overall Program Risk

Alternative A: Full Suppression

In the short term, full suppression poses the least amount of risk to natural resources and developments in the park and surrounding areas. In the long-term, fuel buildups will increase the potential for large, uncontrollable fires that will pose a significant risk to developed areas and natural resources in and near the park.

Alternative B: Management Ignited Prescribed Fire (Prescribed Burning) Only

This alternative presents a low amount of short term risk. Prescribed burns are conducted by trained park personnel and are conducted only in conditions that present an opportunity to control. There is limited potential for fire escape. Long-term risk is moderate as compared to Alternative A.

Alternative C: **Full Mechanical Manipulation (Only)**

This alternative is limiting due to the considerable labor and economic requirements. The limiting characteristic of this technique would eventually allow fuel buildups to continue, increasing the potential for a large, intense wildfire.

Alternative D: Management Ignited Prescribed Fire and Mechanical Manipulation (PROPOSED ALTERNATIVE)

This alternative would allow for the most efficient and effective approach for managing the resource. Risk is lowest because mechanical manipulation creates safety zones around developments, which decrease the risk of escaped prescribed burns.

IMPACT COMPARISON MATRIX
FOR THE IMPLEMENTATION OF A FIRE MANAGEMENT PROGRAM
FOR PRESCRIBED FIRE AND MECHANICAL MANIPULATION
IN GOLDEN GATE NATIONAL RECREATION AREA

IMPACT ON:	**ALTERNATIVE A Full Suppression**	**ALTERNATIVE B Prescribed Burning**	**ALTERNATIVE C Mechanical Manipulation**	**ALTERNATIVE D Prescribed Burning & Mechanical manipulation**
VEGETATION	Major natural processes interrupted	(limited) natural processes partially restored	Major natural processes interrupted	(limited) natural processes partially restored
FUELS	Major natural processes interrupted	(limited) natural processes partially restored	Major natural processes interrupted	(limited) natural processes partially restored
WILDLIFE	Major natural processes interrupted	(limited) natural processes partially restored	Major natural processes interrupted	(limited) natural processes partially restored
THREATENED/ENDANGERED SPECIES	Major natural processes interrupted	(limited) natural processes partially restored	Major natural processes interrupted	(limited) natural processes partially restored
AIR QUALITY	Dependent on severity of fire	Minor-temporary during fire	Minor equipment	Minor-temporary during fire
WATER RESOURCES	Major effects on runoff	Minor – impact temporary	Minor effects on runoff	Minor – impact temporary
SOILS	Major natural processes interrupted	Minor – impact temporary	Major to minor natural processes interrupted	Minor – impact temporary
CULTURAL RESOURCES	Dependent on planning and location	Minor – protection planned for	Dependent on planning	Minor – protection planned for
SAFETY	Major, but temporary during fire	Moderate during fire	Moderate during implementation	Moderate, but temporary during fire
ECONOMIC	Cost high	Cost low	Cost high	Cost moderate
VISUAL OR AESTHETIC VALUES	Major impact	Moderate impact	Moderate impact	Moderate impact
OVERALL PROGRAM RISK	Short term risk low Long term risk high	Short term risk low Long term risk moderate	Short term risk low Long term risk moderate	Short term risk low Long term risk low

V. CONSULTATION AND COORDINATION

The following individuals were consulted in the preparation of this environmental assessment:

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