

Natural Resources Planning and Management in the National Park Service — Pinnacles National Monument¹

Kathleen M. Davis²

Current natural resources planning and management in the National Park Service are the outcome of historical management and policy development. The earliest parks were managed with an indiscriminate multiple use concept where incompatible activities were allowed, such as grazing, mining, logging, and clearing. Establishment of Yellowstone National Park in 1872 marked the beginning of protecting natural ecosystems because public land was withdrawn from settlement, occupancy, sale, and development. This reflected a change of American attitudes to increasing awareness of exhaustible resources and beauty in nature.

In 1916, the National Park Service was created with a mandate to conserve natural resources while providing for enjoyment of the public in a manner that would leave ecosystems unimpaired for future generations. The Service now recognizes the importance of protecting ecological processes and strives for sound management through planning and policies.

PLANNING PROCESS

Natural resources management planning is embodied in the overall planning process of the Park Service. Figure 1 schematically diagrams the process that follows establishment of an area and shows the various levels and types of plans. Public review and input occur on most levels.

Each area has specific enabling legislation describing it and stating purposes for establishment. Intent of enabling legislation determines management and designation of the area, e.g., park, monument, historic site, etc. Areas are added usually in response to public action and nomination.

The first step following legislation is a statement for management that gives a current summary of the state of the park, guides short and long-term management, and helps decision makers determine type and extent of planning required to meet management objectives (U.S. Dept. Int., National Park Service 1978b). These objectives are a list of

¹Presented at the Symposium on Dynamics and Management of Mediterranean-type Ecosystems, June 22-26, 1981, San Diego, California.

²Plant/Fire Ecologist, Western Regional Office, National Park Service, U.S. Department of Interior, San Francisco, California.

Abstract: Preservation of ecological processes rather than scenic objects is the goal of natural resources management. This entails allowing natural events, i.e., fire, insects, flooding, etc., to operate to the fullest extent possible within park boundaries. Ecosystem management for a park is guided by a natural resources management plan that discusses opportunities and problems for working with natural resources. Pinnacles National Monument illustrates an ecosystem management program where prescribed fire is employed to restore native chaparral and oak/pine woodland communities.

desired conditions; for example, maintain native ecosystems in natural zones or provide facilities for visitor use. They are a framework for conserving park resources and accommodating environmentally compatible public uses. Until the general management plan is approved, the statement for management guides day-to-day operations.

The general management plan is a parkwide plan for meeting broad objectives identified in the statement for management. This plan contains short- and long-range strategies for natural and cultural resources, interpretation and visitor use, visitor protection, development (facilities), and maintenance and operations. It identifies concerns and opportunities and the subsequent programs to manage a park as an integrated system.

Specific plans are components of the general management plan as illustrated in the figure. They give detailed discussion of management concerns and describe methods to implement programs. While specific plans are not always prepared concurrently with the general management plan, they are consistent with park management objectives that already have been identified. In a small park, the general management plan may embody all specific plans in one document. However, they are usually separate documents for large parks and any park where administration requires greater detail.

Contents of specific plans depend on the type of park. For example, Statue of Liberty National Monument has plans for visitor use, interpretation, and protection as well as development; a plan for natural resources would be inappropriate.

NATURAL RESOURCES MANAGEMENT

Planning

As shown in the figure, there are various specific plans. Since the topic here is natural resources, the remainder of this paper will focus on the planning and management for natural communities. Fire management in Pinnacles National Monument, a Mediterranean environment, is given as an example.

Ecosystems are described and management is guided by a natural resources management plan that identifies problems and opportunities for working with wildlife, vegetation, air, soil, water, etc. It establishes principal strategies that will be continued, phased out, modified, or initiated for

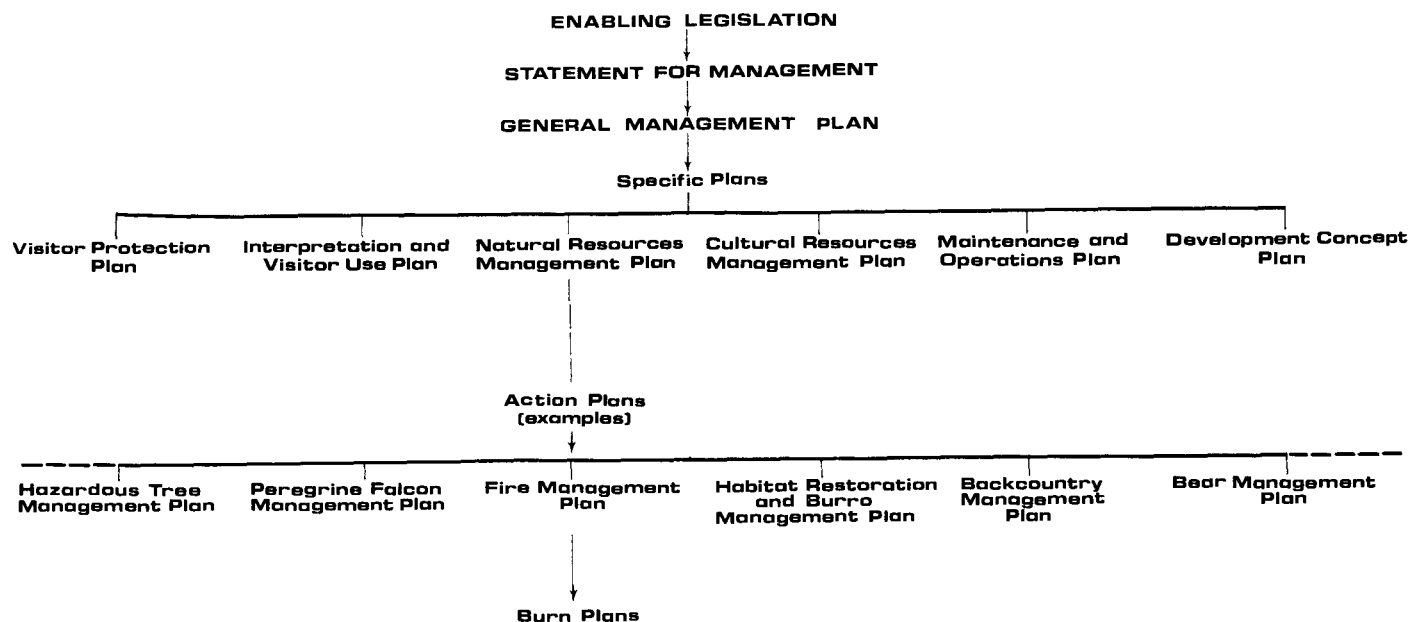


Figure 1--Schematic diagram of the National Park Service planning procedure for natural resources management showing examples of action plans.

the purpose of perpetuating natural resources processes (U.S. Dept. Int., National Park Service 1978a). In the addendum of each plan are project statements, which are proposals for money, personnel, research, or services to deal with such concerns as fire history investigation, exotic species removal, pest control, or fire management.

Action plans originate from a natural resources management plan and are either embodied in the plan or, if complex or lengthy, prepared as separate documents. Action plans focus on particular problems or opportunities for management of such things as native wildlife and vegetation habitat, exotic species, fire, reintroduction of native species, hazardous tree removal, insect and diseases, site rehabilitation, and endangered species. They are working documents used by park staff to achieve a particular condition of natural resources in parks.

Policy

In addition to the mandate of the 1916 National Park Service Act, several legislative actions, executive orders, and mission and policy statements have shaped current management practices. The enabling legislation of each park strongly influences ecosystems management, and for this reason sometimes certain practices must be allowed that do not seem to fit the "idea" of a national park, i.e., hunting, logging, skiing, mining, and maintaining exotic species.

It has only been the last two decades that serious attention has been given to total resources management. When the National Park Service was created, emphasis was placed on protecting objects, e.g., trees, mountains, or volcanoes, as a means to preserve environments. While this philosophy suits some areas such as Gettysburg National Military Park, it is wrong for natural areas such as Lassen Volcanic National Park. Since 1916 the goal of natural resources management has evolved to protecting and promoting ecological processes rather than objects. This change of philosophy is expressed in current management policies (U.S. Dept. Int., National Park Service 1978a):

"Management of...natural features and values is concerned with ecological processes and resources. The concept of perpetuation of a total natural environment or ecosystem, as compared with the protection of individual features or species, is a distinguishing aspect of the Service's management of natural land."

The current servicewide policy for natural resources management was strongly influenced by recommendations of the Advisory Board on Wildlife Management in National Parks, more commonly known as the blue ribbon "Leopold Committee." It stated that maintenance of suitable habitat is the key to sustaining healthy animal populations and that protection of animals is no substitute for providing habitat requirements (Leopold and others 1963).

Habitat is not a stable entity that can be preserved; instead it is the product of various ecological components that create constant change and diversity. In short, the National Park Service was doing a disservice to wildlife and total ecosystems by trying to control natural events such as fire, insect and disease outbreaks, predation, and flooding.

The Leopold Committee recommended a major policy change for the Park Service: to recognize the enormous complexity of ecological communities and diversity of management procedures required to preserve them. Preservation of objects would not keep ecosystems intact; only preservation and protection of ecological processes would.

The Leopold Committee further recommended identifying ecosystems existing at the time technological man appeared and implemented activities that interrupted natural processes. Native people (Indians, Hawaiians, Eskimos) are considered part of the environment because they subsisted directly on resources. As much as possible, efforts should be made to restore biotic associations of that era and then allow ecological processes to operate with the least possible human interference. National parks should represent a vignette of primitive America.

Restoring primitive ecological communities cannot be done easily or completely because prior to inclusion into the Park Service, most areas went through periods of indiscriminate uses of resources even to the point of extinction of some plants and animals. Also, some later activities by the National Park Service contributed to the accelerated alteration of ecosystems, i.e., predator control, fire suppression, insecticide use, etc. Yet, if the goal cannot be fully achieved, it can be approached using the utmost skill, judgment, and ecological sensitivity.

FIRE MANAGEMENT IN NATIONAL PARKS

Automatic suppression of all fires regardless of cause has had a long history in the Park Service; consequently, a dramatic effect on ecosystem. It began as standard procedure with Yellowstone in 1872 and continued as policy for other areas entering the system. Suppression was justified by strong conviction that fire caused nutrient and soil loss, destruction of plant and animal life, forage reduction, and ugly landscapes. Misunderstandings of the natural role of fire and interrelationship of ecological components also added to prejudice against fire.

Prescribed fire was specifically mentioned by the Leopold Committee as an essential tool to manage fire-adapted biotic associations. The report gave examples of significantly altered ecosystems resulting from fire exclusion by pointing out changes and decline in fire-adapted plant and animal communities. In 1968 the Park Service made policy the revolutionary proposal of the committee to return fire to parks.

Since 1968, policy has been revised and expanded to accommodate growth of fire management in the Service. Following are excerpts from current policy (U.S. Dept. Int., National Park Service 1978a):

"The presence or absence of natural fires within a given ecosystem is recognized as a potent factor stimulating, retarding or eliminating various components of the ecosystem. Most natural fires are lightning-caused and are recognized as natural phenomena which must be permitted to continue to influence the ecosystem if truly natural systems are to be perpetuated.

"Natural zones should represent the full spectrum of the parks' dynamic natural vegetative patterns. Sharply defined zones or blocks of vegetation limited to certain species locked in over time are not natural and only rarely justified.

"Prescribed natural fire is the preferred means to achieve the prescriptions in natural zones...prescribed burning may be used as a substitute for prescribed natural fire in natural zones only where the latter cannot meet park objectives. In natural zones, the objective for prescribed burning is to stimulate to the fullest extent the influence of natural fire on the ecosystem.

"All fires not classed as management fires are "wildfires" and will be suppressed... (in a manner) causing the least resource damage, commensurate with effective control."

Returning fire to its ecological role must be based on clearly defined management objectives discussed in the natural resources management plan. Depending on the situation in a park, prescribed natural fire and/or prescribed burning may be used. Fire suppression always remains in the program. These aspects of Park Service fire management are discussed further:

--Prescribed natural fires result mainly from lightning and volcanic eruptions, and they are permitted to burn during predetermined prescriptions and within established boundaries. This is the preferred method for carrying out a fire program, and there are two situations where it is used. First, it is a continuation program after prescribed burning has reduced hazardous fuels that resulted from years of suppression. Second, it can be used initially where pretreatment is not needed because suppression has not created heavy fuel loads.

--Prescribed burning is intentional ignition of vegetation and litter by park staff done to simulate the natural role of fire or reduce fire hazard. Following years of fire exclusion, several burns over a period of time may be necessary to achieve a more natural state of fuels and vegetation. Preferably, a natural fire program would follow prescribed burning, but some parks may need

to continue a prescribed burning program indefinitely because of boundary considerations or limited natural ignitions within administrative boundaries. The National Park Service has no policy against prescribed burning in designated wilderness.

--Unwanted fires, or wildfire, will be suppressed regardless of origin. This occurs when fire threatens cultural resources, human life, and property; exceeds prescription; threatens to cross a boundary; or otherwise does not meet management objectives. While the Service's policy is to suppress human-caused fires, a few exceptions have been given on a park-by-park basis for certain situations when a fire meets management goals, when suppression impacts would be long lasting, and when suppression is not cost effective for public dollars. Sometimes common sense is an equalizer.

Fire exclusion is a serious form of environmental tinkering recognized years ago by some individuals in the Service. A research burning program began in Everglades National Park, Florida, in 1951. In 1968, research burns were used in Sequoia and Kings Canyon National Parks, California, that led to the first natural fire program in the Service. Since the start of total fire management within these parks, several others have or are developing programs. A goal for natural resources management is to return fire to all natural areas in parks where administratively possible.

PINNACLES NATIONAL MONUMENT--AN EXAMPLE

Environment

Pinnacles National Monument is in the central coast range of California about 130 miles (209 kilometers) south of San Francisco. Established as a forest reserve in 1906, it became a National Monument in 1908 first administered by the Forest Service then transferred to the National Park Service in 1923. The enabling legislation established it for protection of unique volcanic rock formations, but later Pinnacles was enlarged to 16,233 acres (6558 hectares) to include surrounding chaparral and oak woodland communities and native wildlife habitat. In 1975, most of the monument was designated wilderness by Congress.

Climate is a mediterranean type with dry, hot summers and cool, moist winters. Rainfall averages 16 inches (41 centimeters) occurring mainly in winter months. Topography is rugged and steep with ridges, peaks, and deep canyons created by volcanic activity and erosive forces. Soils are mostly sandy loams and very erosive. Generally, they have little development with low nutrient and water-holding ability.

Vegetation is composed of chaparral and oak/pine woodland communities. Major species are chamise, manzanitas, buckbrush, holly leaf cherry, digger pine, blue oak, and coast live oak. About 80 percent of the cover is chaparral, 7 percent oak/pine woodland, and 13 percent riparian or

xeric (Webb 1971).

A variety of wildlife species occur. Most notable are blacktail deer, bobcat, raccoon, grey fox, coyote, rattlesnake, gopher snake, prairie falcon, turkey vulture, raven, and golden eagle. In the past this was part of the range for California condor. Diverse habitat requirements, especially food and cover, have been lacking for wildlife primarily due to homogeneous, over mature plant communities resulting primarily from fire suppression.

Fire History

Pinnacles has a classic fire environment where climate, topography, and vegetation create a situation for cyclic fires. A fire history report recently completed for the monument and surrounding Gabilan and Diablo Ranges gives a better understanding of past fires and their effects (Greenlee and Moldenke 1981). By studying current lightning patterns, the authors proposed that prehistoric lightning fires started mainly in oak or pine trees at higher elevations during early summer and fall. Hold over fires in trees probably were not unusual. Fire spread was extensive in grass and shrub fuels, and crowning was uncommon. A good portion of the area was probably oak/pine woodland with scattered large brushfields.

With the arrival of Indians about 11,000 years ago, burning in fall, and perhaps spring, became customary. Fire was used for various purposes including harvesting of plant foods, hunting, and burning houses to kill ticks and fleas. The overall effect on vegetation communities is suspected to be a maintenance of oak/pine woodlands and possibly reduction of shrubfields. The location of archeological sites in Pinnacles strongly supports this deduction of vegetative condition because sites have been found in dense chaparral. It is inconceivable that Indians would have lived surrounded by hazardous fuels while conducting their own use of fire. There were also lightning-caused fires during this era, so all evidence strongly suggests a more open vegetative condition than now exists.

Spanish and Mexican settlement from late 1700's to 1848 drastically removed Indians as an ignition source by bringing them into missions and ranches. Heavy use of grazing lands by increasing herds of cattle, sheep, and horses degraded natural grasslands and woodlands through erosion, compaction, and introduction of exotic plants. While most impact was in valleys, stock did move into mountainous areas. The result of settlement activities was that grasslands and woodlands decreased while shrubfields increased. Fire probably became less frequent and more intense as chaparral fuels accumulated.

After 1848, Anglo settlers dominated the region. They cut oak and pine for housing, fuel, and forage as well as clearing agriculture land. Drought,

fire, and clearing reduced tree cover, and chaparral extended into former grasslands and woodlands on hills as farming superseded ranching and excluded cattle. Today remnants of large oaks are found in shrubfields providing evidence that oaks occurred throughout the monument. By late 1800's severe fires were occurring in chaparral and reducing the tree component.

The twentieth century brought fire-fighting organizations. Suppression lengthened the burning cycle, so fuels accumulated to abnormal loadings. While fire-fighting became quicker and more efficient, fire severity in homogeneous fuels increased. Records of fires since 1877 show that most fires have entered Pinnacles from the north, and that widespread fires in 1877 and 1900 covered much of the monument. Since 1927 most of the monument has burned, and some areas have burned two or three times. The most recent large fire was in 1931, but since then most have been small, more frequent, and difficult to control. Fire frequency prior to settlement would have varied with fuel types, and it is difficult to give average frequencies for the monument because of the lack of fire-scarred trees. Current evidence suggests a frequency of about 20 years throughout the monument.

Fire Management

The statement for management covers fire in the management objective to preserve and protect natural resources by perpetuating coastal biotic communities by reintroducing natural processes suppressed by man. The general management plan recognizes fire as an integral element and further states that suppression created over-mature botanical communities declining in plant and animal variety as well as stability. It states prescribed burning is necessary to reestablish natural succession of ecosystems. The natural resources management plan describes the interrelationship of fire in Pinnacles' ecosystems and the effects of total suppression. It calls for a fire history study, a fire effects study, and a fire management plan to include prescribed burning while improving protection from unwanted fires.

A wildfire in 1974 that entered from adjacent lands was the start of a new fire management plan. In keeping with Park Service policy, bulldozers were not allowed to construct fireline in the monument unless an emergency existed. Consequently, the fire was allowed to burn a larger area while natural barriers and hand lines were used for containment. Circumstances associated with this fire and the potential threat to park visitors, staff, and facilities focused attention on the immediate need to treat hazardous fuels as well as return fire to the ecosystem.

In 1975 Dr. Harold Biswell was contacted to write a fire management plan that would enable the staff to reduce heavy fuels and restore fire in a manner to recreate as much as possible the eco-

system that would have existed now had natural fires always burned in the monument. Prescribed burning was selected because of the heavy, continuous fuels, experimental nature of the beginning program, desire to choose when and where fire is used, and infrequent lightning fires. Biswell (1976) proposed a 20-to 30-year rotation for burning 600 to 800 acres (240 to 320 hectares) yearly to create a mosaic for ecological diversity and safety from wildfire. Three firing techniques were recommended:

--Upslope strip burning in chaparral in winter and early spring;

--Broadcast burning in chaparral and oak/pine woodland after grasses are cured, which usually is May;

--Broadcast burning in chaparral and oak/pine woodland soon after initial fall rains, usually in late October or November.

Program Implementation

Parcels of 50 acres (20 hectares) or less are burned around developed sites, i.e., monument headquarters, ranger station, housing, and picnic grounds. In wilderness, larger parcels of 100 to 200 acres (40 to 80 hectares) are treated. An area is considered treated when management objectives are met: increasing safety from wildfire and re-establishing natural succession associated with fire.

Fire behavior is predicted using weather data and National Fire Danger Rating System (NFDRS) components and indices based on information from monument headquarters weather station. Specific details are gathered from a remote station placed on proposed burn sites. Live fuel moisture is monitored daily or weekly since live crowns of chaparral strongly influence fire behavior. Chamise and buckbrush live fuel moistures are measured near headquarters and on selected burn sites.

Prior to ignition, burn plans are written for approval by the superintendent. They are working plans that provide tactical details on dates, locations, objectives, organization, logistics, topography, weather, fuels, firing and holding operations, communications, safety, and maps. An air quality clearance and burning permit are obtained from county representatives before ignition.

Fireline construction is minimal since natural barriers are used, especially vegetation and fuel moisture changes, ridgelines, gullies, shade, and bare areas. Each fire is staffed by 2 or more people applying fire and observing behavior. Park fire crews contain and cold trail when necessary.

Program Results

From general conditions provided in Biswell's plan, a prescription is being continually refined. Model B of the National Fire Danger Rating System is used (table 1). To date prescribed burning has been done primarily in southfacing chaparral stands and oak/pine woodlands, but more attention is being given to moist northfacing slopes since fuel breaks have been created. Most burning is done in the optimum range, but for moist sites it is necessary to take calculated risk on the dry side of the minimum and maximum range.

Table 1--Fire prescription for Pinnacles National Monument (NFDRS Model B).

	Ranges	
	Min.-Max.	Optimum
Temperature (F)	40-94	65-84
Relative humidity (pct)	8-100	25-35
Windspeed (mph)	0-35	<10
10-hour time lag moisture (pct)	4-14	7-9
Live fuel moisture (pct)	42-180	80-120
Spread component	0-16	6-12
Energy release component	0-45	25-44
Burning index	0-58	35-50

Three firing techniques have evolved for Pinnacles (Clark 1981):

--Upslope strip burning in chaparral--Fire is set at the base of a thick stand of brush and induced to run upslope. As flames become self-sustaining, the burner ignites vegetation while walking downhill so fire behavior is controlled by indrafts of the main fire. This technique creates rapid, but short-lived mass fire that dies at fuel breaks. Upslope fires occur at the hottest, driest period of the day usually in spring and fall.

--Broadcast burning on ridges and slopes--Grass is the main carrier of fire. Burners begin early in the day along ridges then move downslope and along contours until one burner ties in with another. This method resembles a strip headfire pattern. Backing fires under pine and oak are desired, and every opportunity is taken to drop below a shrubfield in order for intense fire to burn the stand.

--Pile burning--On occasion this method is used for special projects such as access routes before upslope strip burning, perimeter control, mop up, and localized hazard reduction. Piles are also cut for fuel triggers to generate heat for upslope strip burning.

From 1977 through 1980 a total of 1,001 acres (405 hectares) and 204 piles have been burned at

an average cost of \$11.59 per acre (\$28.63 per hectare) (Clark 1981). Average costs have decreased as the program becomes more routine and park staff more efficient. While \$11.59 may seem expensive when compared to costs of about \$5.00 per acre when using a helitorch, it must be remembered that the goal is to burn small area mosaics in a limited acreage per year. Fireline construction is minimal, heavy equipment is not used, and fuels are not pretreated by crushing or spraying.

Prescribed burns have been carried out cooperatively with neighbors. One burn was a joint effort with an adjacent rancher, Department of Interior Bureau of Land Management, and California Department of Forestry. More cooperative burns are planned as a means to achieve management objectives and reduce costs.

Visitation to Pinnacles National Monument is heaviest on weekends; therefore, prescribed burning is conducted on weekdays. Interpretive displays in the visitor centers and contact with park staff inform the public about the fire program. Use of fire has wide support from the visiting public and neighbors.

SUMMARY

To summarize, it is appropriate to talk about commitment and action. Natural resources management planning and policies are vehicles for ecological stewardship of land. However, they are ineffectual unless carried out by people with commitment to natural resources programs.

Success of the Pinnacles National Monument prescribed fire program is due to commitment of people. Superintendent Rod Broyles knew fire belonged for ecological reasons as well as for safety. He acquired funding after a wildfire to hire a qualified person to start a prescribed fire program. Forestry technician Dean Clark combined his experience of fire ecology, behavior, and suppression to develop a "back-to-basics" program that incorporates knowledge of local area residents. Park staff work strenuously to prepare for a burn and carry it out. Consultants, volunteers, and other Park Service employees also contribute to make this fire program serve nature and management.

Taking action in a prescribed fire program is a determined step, especially considering potential risks. But there are greater risks living in hazardous fuels and trying to prevent natural processes. Too often, management postpones taking action to wait for all the information, but rarely can all the information be gathered without taking action. Pinnacles is an example where management used what it knew to start a program then grew with the program. Monument staff began prescribed burning with guidelines from the fire plan and the knowledge that fire belongs in the monument. As they develop skills using fire, they are learning about ecological effects and practicing suppression techniques. They are becoming experienced managers

of fire and natural resources.

Fire history information continues to be incorporated as prescriptions are refined and historic biotic communities restored. Further study of fire effects is proposed to gain more understanding of ecological relationship. Several interesting responses have been noticed since the program began in 1977. Seven new plant species recorded for Pinnacles have been found on recently burned areas, the seed having been stored in the soil. One, the fire poppy, illustrates an obvious association with fire. Four species of manzanitas occur that do not regenerate by root sprouts, thus depend on fire to crack hard seed coats and perpetuate the species. Strong response of native perennial grasses after fire where chaparral formerly dominated and remnants of oaks in brushfields support the belief that oak/pine woodlands historically covered more of the monument. A species of wasp was discovered that burrows a few inches underground and requires fire to break dormancy. It is through burning, studying observations, and incorporating results that we progress. As we burn, we learn.

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