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APPENDIX 1

Fire management glossary

Active Crown Fire: When the main surface fire and the fire burning in the crowns are moving together across the fire front.

Adaptive Management: A type of natural resource management that implies making decisions as part of an on-going process. Monitoring the results of actions will provide a flow of information that may indicate the need to change a course of action. Scientific findings and the needs of society may also indicate the need to adapt resource management to new information.

Alluvial: Pertaining to processes or materials associated with transportation or deposition by running water.

Alluvium: A deposit of sediment left by a stream on the stream's channel or floodplain.

Appropriate Management Response: The response to a wildland fire is based on an evaluation of risks to firefighter and public safety, the circumstances under which the fire occurs, including weather and fuel conditions, natural and cultural resource management objectives, protection priorities, and values to be protected. The evaluation must also include an analysis of the context of the specific fire within the overall local, geographic area, or national wildland fire situation.

Aquatic: Growing or living in or frequenting water; taking place in or on water.

Aquatic Ecosystem: A stream channel, lake or estuary bed, the water itself, and the biotic (living) communities that occur therein.

Aridisols: soils that are too dry for mesophytic plants to grow. They are CaCO_3 -containing soils of arid regions that exhibit at least some subsurface horizon development. They are characterized by being dry most of the year. Aridisols contain subsurface horizons in which clays, calcium carbonate, silica, salts, and/or gypsum have accumulated.

Aspect: The direction a slope faces. For example, a hillside facing east has an eastern aspect.

Bajadas: Shallow slopes that lie at the base of rocky hills, where materials accumulate from the weathering of the rocks. They typically have a mixture of boulders, stones, gravel, sand and silt particles, creating a deep and complex soil structure that retains water and supports a rich vegetation.

Biological Diversity (Biodiversity): The number and abundance of species found within a common environment. This includes the variety of genes, species, ecosystems, and the ecological processes that connect everything in a common environment.

Biomes: One of the major categories of the World's distinctive plant assemblages.

Biomass: 1. Wood products that may or may not be used commercially

2. The total weight of all living organisms in a biological community.

Biota The plant and animal life of a particular region.

Biotic Potential: Factors that influence the ability of an animal to utilize its environment, including: reproductive rates, dispersal ability, habitat and life requisite specificity, and adaptability. Combine, these factors assign biotic potential of the animal.

Bole: Trunk of a tree.

Buffer: Used in the context of GIS; a buffer is a zone of a specified distance around a feature in a coverage.

Burned Area Rehabilitation: The full range of post- fire activities to rehabilitate and restore fire damaged lands, including protection of public health and safety.

Canopy: The part of any stand of trees represented by the tree crowns. It usually refers to the uppermost layer of foliage, but it can be used to describe lower layers in a multi- storied forest.

Cat Faces: Fire scars left from fire burning on a tree usually at the base of the tree, can be on live or dead trees.

Catastrophic Fire: See stand replacing fire.

Collaboration: Managers, scientists and citizens working together to plan, implement and monitor land management activities. The intention is to engage people who have information, knowledge, expertise and an interest in the health of natural ecosystems and nearby communities.

Control Burn: See Prescribed Fire or Burn.

Cooperators: Federal, state, and local agencies and Indian tribes that participate in planning and conducting fire management projects and activities.

Critical Habitat: Areas designated for the survival and recovery of state or federally listed threatened or endangered species.

Cryptogamic: Soil Crusts (Microbiotic Soil Crusts) Arid and semi- arid soil surface communities consisting of green algae, cyanobacteria, diatoms, non- lichenized fungi, lichens, bryophytes, bacteria, protozoans in various combinations. They stabilize soil surfaces, concentrate certain mineral and organic nutrients, alter water infiltration while consistently reducing sedimentation, and facilitating seed germination and seedling establishment.

Degradation: Reduction in quality. 1. The process whereby the water quality and chemical, physical or biological integrity of a water body is decreased. 2. Habitat quality can be changed by certain management activities. If the quality is reduced then habitat degradation has occurred.

DEIS (Draft Environmental Impact Statement): A working document that is released to governmental agencies and the general public for review and comment.

Designated Areas: A mapped area with an identified Desired Condition and specific management direction to move toward the Desired Condition.

Early Forest Succession The biotic (or life) community that develops immediately following the removal or destruction of vegetation in an area. For example, grasses may be the first plants to grow in an area that was burned.

Ecology: The interrelationships of living things to one another and to their environment, or the study of these interrelationships.

Ecosystem: An arrangement of living and non- living things and the forces that move them. Living things include plants and animals. Non- living parts of ecosystems may be rocks and minerals. Weather and wildland fire are two of the forces that act within ecosystems.

Ecotone: A zone of intergradations between ecological communities.

Ecosystem Sustainability the capacity to maintain ecosystem health, productivity, diversity, and overall integrity, in the long run, in the context of human activity and use.

Encinal: Mild winter woodlands

Endangered Species: Those plant or animal species that are in danger of extinction throughout all or a significant portion of their range. Endangered species are identified by the Secretary of the Interior in accordance with the Endangered Species Act of 1973.

Endemic: An organism that evolved in and is restricted to a particular locality. The Yosemite Toad found only in the Sierra Nevada region is an example.

Ephemeral Stream: Streams that flow only as the direct result of rainfall or snowmelt. They have no permanent flow.

Escarpment: A long, more or less continuous cliff or relatively steep slope produced by erosion or by faulting.

Fauna: The animal life of an area.

Fine Fuels: Fuels that ignite readily and are consumed rapidly by fire (e.g., cured grass, fallen leaves, needles, small twigs less than ¼ inch diameter, also referred to as 1- hour fuels).

Fire Extent: The size of the area that burned.

Fire Frequency: A general term referring to the recurrence of fire in a given area over time.

Fire Hazard: A fuel complex, defined by volume, type, condition, arrangement, and location, that determines the degree of ignition and of resistance to control. For example, the moisture content of the fuel will influence the ability of the fuel to catch and sustain fire (degree of ignition) and how difficult it will be to control or extinguish the fire (degree of control).

Fire Management: Activities Include fire planning, fire management strategies, tactics, and alternatives, prevention; preparedness, education, and addresses the role of mitigation, post- fire rehabilitation, fuels reduction, and restoration activities in fire management.

Fire Management Plan: A strategic plan that defines a program to manage wildland fires based on an area's approved land management plan. Fire Management Plans must address a full range of fire management activities that support ecosystem sustainability, values to be protected, protection of firefighter and public safety, public health and environmental issues, and must be consistent with resource management objectives and activities of the area.

Fire Regime: The combination of fire frequency, predictability, intensity, seasonality, and extent characteristic of fire in an ecosystem.

Fire Return Interval: Expressed as a range of years or as the arithmetic average (mean fire return interval) of all fire intervals in a given area over a given time period.

Fire Risk: See wildland fire risk.

Flora: The plant life of an area.

Floristics: The study of a particular association of plants or plant communities.

Focal Species: A species of concern.

Fuel Hazard: A fuel complex defined by kind, arrangement, volume, condition, and location that forms a special threat of ignition and resistance to control.

Fuelbreak: A system of linear or mosaic patch treatments of forest or shrub vegetation designed and treated to reduce fire spread, intensity, and create barriers to fire spread.

Fuel load: The amount of combustible material (dead plants and trees, litter, and duff) that is found in an area.

Fuels: Plants and woody vegetation, both living and dead, that are capable of burning.

Fuels Management: The planned manipulation and/or reduction of living and dead forest fuels for forest management and other land use objectives.

Fuels Treatment: The treatment of fuels that left untreated, would otherwise interfere with effective fire management or control. For example, prescribed fire can reduce the amount of fuels that accumulate on the forest floor.

Geographic Information Systems (GIS): A computer system capable of storing, manipulating, analyzing, and displaying geographic information.

Habitat The area where a plant or animal lives and grows under natural conditions.

Handline: A line cleared of all vegetation and fuels (down to mineral soil) used to help control a fires spread. Width varies depending on fuel type.

Hand Thinning: A method used to trim limbs from trees as well as cut down individual trees using a chainsaw, crosscut saw, or axe.

Hazard Reduction In fuels management: the planned treatment or manipulation of naturally growing vegetation or any other flammable material for the purpose of reducing the rate of spread and the output of heat energy from any wildland fire occurring in the treated area.

Hazard Reduction Prescription: These are the specific parameters used to describe the conditions such as specific width, patch size and shape, species composition, diameter distributions, canopy cover, surface fuel mosaic, fire behavior, and location. They are determined at the site- specific project level based on topography, access, vegetation, risk of ignition, and potential fire behavior (this includes weather and wind).

Helispots: Areas cleared of vegetation and dead and down fuels used to land helicopters.

Indigenous (Species): Any species of plant or animals native to a given land or water area by natural occurrence.

Initial Attack: The aggressive response to a wildland fire based on values to be protected, benefits of response, and reasonable cost of response.

Interdisciplinary Team: A diverse group of professional resource specialists who analyze the effects of Alternatives on natural and other resources. Through interaction, participants bring different points of view and a broader range of expertise.

Interagency Coordination: collaboration, communication among cooperating agencies.

Intermittent Stream: A stream that flows only at certain times of the year when it receives water from streams or from some surface, such as melting snow.

Landscape: A large land area composed of interacting ecosystems that are repeated due to factors such as geology, soils, climate, and human impacts.

Late Forest Succession: The stage of forest succession in which most of the trees are mature or overmature.

Lithology: The physical and/or chemical character of a rock or geologic layer generally observed in the field with a low powered lens or the naked eye.

long- term Risk: A risk to be experienced within the next 50 to 100 years.

Management Action Any activity undertaken as part of the administration of the national park.

Managed Wildland Fire: A natural (lightning) ignited fire that is managed to meet resource benefits.

Meadow: Tracts of moist low lying and usually level grasslands. Generally, the water table is just below the surface of the soil and the most abundant vegetation is usually favored by wet but not constantly flooded soil.

Mesic: 1. Moderately moist climates or environments. 2. **Vegetation:** generally refers to vegetation found in moist environments.
3. **Soils:** refers specifically to soils with mean annual temperatures of 8 to 15 degrees centigrade.

Mop Up: Action that entails securing or cleaning up the fire after fireline is established (could be internal or around the perimeter).

Mop Up(Internal): Action that entails securing the fire internally (not around the fire line) after fire line is established.

Mosaic: Areas with a variety of plant communities over a landscape. For example, areas with trees and areas without trees occurring over a landscape.

National Park: A tract of land declared public property by a national government so as to be preserved and protected for recreational, scenic, ecological or cultural purposes.

Natural Resource: A feature of the natural environment that is of value in serving human needs.

Natural Succession: The natural replacement, in time, of one plant community with another. Conditions of the prior plant community (or successional stage) create conditions that are favorable for the establishment of the next stage.

Noxious Weeds: Aggressive, non- native plant species that have been introduced. They can be difficult to manage, poisonous, toxic, parasitic, or carrier of insects or disease.

Old Forest (Old Growth): Areas that contain large, old trees relative to the species- specific, environmentally- constrained growth capacity of the site.

Owl and Goshawk PACs: See Protected Activity Centers.

PM 10 and 2.5: These are Particles found in the air. They can come in almost any shape or size, and can be solid particles or liquid droplets. One of the differences is size, we call the bigger particles PM10 and we call the smaller particles PM2.5.

Paleoecological: The study of ancient or prehistoric ecosystems.

Passive Crown Fire: An intense surface fire that torches occasional individual trees or small groups of trees, during this condition the surface fire is moving faster than the occasional torching of trees. Any spotting is usually short range less than ¼ mile and supports the surface fire spread.

Patch: An area of vegetation, similar in structure and composition.

Pediment A broad surface at the base of a receding mountain.

Perennial Stream: A stream that typically has running water on a year- round basis.

Prescribed Fire or Burn: Any fire ignited by management actions to meet specific objectives. Prescribed fires are conducted in accordance with prescribed fire plans.

Prescribed Fire Plan: A plan for each prescribed fire. Plans are documents prepared by qualified personnel, approved by the agency administrator, and include criteria for the conditions under which the fire will be conducted (a prescription).

Prescription: Measurable criteria that define the conditions under which a prescribed fire will be ignited, guide selection of appropriate management responses, and indicate other required actions. Prescription criteria may include safety, economic, public health, and environmental, geographic, administrative, social, or legal considerations.

Protected Activity Centers (PACs): Designated areas that are afforded protection to specific species by restricting certain management activities. For example, California spotted owl PACs protect owl habitat and breeding areas by restricting timber harvest.

Public Involvement: The use of appropriate procedures to inform the public, obtain early and continuing public participation, and consider the views of interested parties in planning and decision-making.

Remote Sensing: Acquiring information about a geographic feature without contacting it physically. Methods include aerial photography and satellite imaging.

Resilience: The ability of an ecosystem to maintain diversity, integrity, and ecological processes following a disturbance.

Riparian Area: The area along a watercourse or around a lake or pond.

Riparian Ecosystem The ecosystem around or next to water areas that support unique vegetation and animal communities as a result of the influence of water.

ROD (Record of Decision): An official document in which a deciding official states the alternative that will be implemented from a prepared EIS.

Satellite Image A picture of the earth taken from a satellite in orbit around the earth.

Sensitive Species: Plant or animal species which are susceptible to habitat changes or impacts from activities.

Seral Stage: The stage of succession of a plant or animal community that is transitional. If left alone, the seral stage will give way to another plant or animal community that represents a further stage of succession.

short-term Risk: A risk to be experienced within the next 10 to 15 years. For example, prescribed burns can disturb habitat in the short-term, but in the long-term the fire resiliency of the habitat may be improved.

Snag: A standing dead tree. Snags are important as habitat for a variety of wildlife species and their prey.

Snagging: A method used for safety on the fireline, which involves the cutting down of snags deemed hazardous.

Species: A class of individuals having common attributes and designated by a common name; a category of biological classification ranking immediately below the genus or subgenus; comprising related organisms or populations potentially capable of interbreeding.

Spike Camps: A remote area used as a temporary camp- site for field crews.

Stand A group of trees that occupies a specific area and is similar in species, age, and condition.

Standards and Guidelines: The primary instructions for land managers. Standards address mandatory actions, while guidelines are recommended actions necessary to a land management decision.

Stand- Replacing Fire: A fire that burns with sufficient intensity to kill the majority of living vegetation over a given area (grass and brush fires are stand replacement fires for that vegetation type, in forest vegetation types when 75- 80% of the stand is killed by fire are also considered stand replacement fires).

Threatened Species: Those plant or animal species likely to become endangered throughout all or a specific portion of their range within the foreseeable future as designated by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973.

Treatment Area: The site- specific location of a resource improvement activity.

Understory: The trees and woody shrubs growing beneath branches and foliage formed collectively by the upper portions of adjacent trees.

Values To Be Protected: Include property, structures, physical improvements, natural and cultural resources, community infrastructure, and economic, environmental, and social values.

Visual Quality: The visual resources; terrain, geological features, or vegetation.

Watershed: The entire region drained by a waterway, lake, or reservoir. More specifically, a watershed is an area of land above a given point on a stream that contributes water to the streamflow at that point.

Wilderness And Wild And Scenic River: Wilderness and Wild and Scenic Rivers are Congressionally mandated areas withdrawn from location and entry under the US mining laws.

Wildland: An area in which development is essentially non- existent, except for roads, railroads, powerlines, and similar transportation facilities

Wildland Fire Any non- structural fire that occurs on wildlands that is not a prescribed fire.

Wildland Fire Implementation Plan (WFIP): A progressively developed assessment and operational management plan that documents the analysis and selection of strategies and describes the appropriate management response for a wildland fire being managed for resource benefits. A full WFIP consists of three stages. Different levels of completion may occur for

differing management strategies (i.e., fires managed for resource benefits will have two- three stages of the WFIP completed while some fires that receive a suppression response may only have a portion of Stage I completed).

Wildland Fire Risk: The probability of a fire occurring.

Wildland Fire Threat: The potential fire behavior and related fire effects (rate of spread, fire intensity, tree mortality, structure loss, etc.) due to the interactions of fuels, weather, and topography.

Wildland Fire Use for Resource Benefit: See Managed Wildland Fire

Wildland Urban Interface: Defined as the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

Xeric: A soil moisture regime common to Mediterranean climates that have moist cool winters and warm dry summers. A limited amount of water is present but does not occur at optimum periods for plant growth.

Acronyms and Abbreviations

ADEQ Arizona Department of Air Quality
BAER Burned Area Emergency Rehabilitation
BLM Bureau of Land Management
BMP Best Management Practice
CAA Clean Air Act
CEQ Council on Environmental Quality
CFR Code of Federal Regulations
cfs cubic feet per second
CO carbon monoxide
DO Director's Order
DOI U.S. Department of the Interior
EA Environmental Assessment
EIR Environmental Impact Report
EIS Environmental Impact Statement
EMFAC Emission Factor
EPA U.S. Environmental Protection Agency
FESA Federal Endangered Species Act
FEMA Federal Emergency Management Agency
ft/sec feet per second
FMU Fire Management Unit
FONSI finding of no significant impact
gal. gallons
GIS geographic information system
GMP General Management Plan
ID Interdisciplinary team
MIST Minimum Impact Suppression Techniques
MMA Maximum Manageable Area
MOA Memorandum of Agreement

MOU Memorandum of Understanding
mph miles per hour
NA not applicable
NAAQS National Ambient Air Quality Standards
NEPA National Environmental Policy Act
NHPA National Historic Preservation Act
NO₂ nitrogen dioxide
NO_x nitrogen oxide
NPS National Park Service
NRCS Natural Resources Conservation Service
NRHP National Register of Historic Places
NWCG National Wildfire Coordinating Group
NWI National Wetlands Inventory
O₃ ozone
PA Programmatic Agreement
PL Public Law
PM particulate matter, when used as PM₁₀ or PM_{2.5}
ppm parts per million
ROD Record of Decision
SHPO State Historic Preservation Office (or Officer)
SOF Statement of Findings
SWRCB State Water Resources Control Board
TES threatened and endangered species
USC U.S. Code
USFS U.S. Forest Service
USFWS U.S. Fish and Wildlife Service
USGS U.S. Geological Survey
UTM Universal Transverse Mercator
WFSA Wildland Fire Situation Analysis
WFIP Wildland Fire Implementation Plan
YR year

APPENDIX 2-
DRAFT-
Cultural Resource Component of the Fire Management Plan,
Saguaro National Park

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Relationship of the CRC to the FMP

The Cultural Resources Component (CRC) of the FMP for Saguaro National Park is an Appendix of the 2003 FMP designed to serve as guidance for management of cultural resources during fire events - - both treatment and mitigation measures. The draft CRC prepared for Chiricahua National Monument (Gebow and Harper 2003) was used as a model for the Saguaro NP CRC.

Two important components of the CRC for Saguaro National Park are Table 1, a matrix displaying the types of cultural resources at the park and the recommended fire treatments for these sites. Table 2 is a summary of actions recommended for cultural resources when planning or responding to fire management undertakings.

Scope of the CRC

Saguaro National Park, in Pima County, Arizona, is in the process of updating its fire management plan (FMP). The cultural resource component (CRC) for this plan identifies specific values and objectives for preserving and maintaining cultural resources in a desired state with regard to fire management strategies. Values are defined as the unique research and interpretive potential of cultural resources that are at risk from fire program activities. Objectives have been defined by considering possible fire management strategies and how each strategy might be used to benefit, maintain, or limit the loss of core values.

The CRC should be viewed as an active component of the fire management plan and used as a planning and operations guide to prevent resource loss or degradation. The CRC will provide guidance for compliance with NRHP for the term of the FMP. Communication and consultation with cultural resource personnel about key fire program activities should continue as needed.

Fire Management Plan Goals and Objectives

Cultural sites, structures, and artifacts are resources requiring actions with varying fire management actions and responses. The following cultural resources goals and objectives spell out appropriate fire management activities for particular cultural resource elements at Saguaro National Park. These goals and objectives are consistent with the overall goals and objectives for fire management as described in the FMP.

Goal 1: Tailor fire management activities and response to accomplish desired cultural resource management objectives, accounting for the specific cultural resource elements at risk in the cultural resource matrix (see Table 1).

- Ensure that fire personnel are appropriately qualified and briefed as to cultural resource fire management guidelines, or are supervised by a qualified cultural resource advisor.
- Allow wildland fire as a natural process in areas with identified cultural resources, where significant detrimental impacts will not occur.
- Reduce fuels in and around sites and artifacts using prescribed fire and mechanical fuel reduction, when appropriate.
- Manage the movement of fire into an identified sensitive cultural resource area taking safety and natural resource protection into consideration.

Goal 2: Base fire- related cultural resource management activities on sound data obtained through survey, monitoring, and stakeholder involvement.

- Consult Native American tribes regarding sacred sites.
- Ensure consultation with qualified resource personnel in conjunction with fire line construction and other suppression activities as necessary.
- Conduct post- fire survey and monitoring, as appropriate.
- Incorporate results into resource management planning and execution.

Goal 3: Implement an appropriate response when previously unidentified cultural resources are discovered or unanticipated, significant detrimental impacts occur.

- Implement the procedures for discoveries of unknown resources when they occur.
- When unanticipated, significant detrimental impacts occur to cultural resources, implement appropriate emergency stabilization and rehabilitation response.

Scope of the Cultural Resource Component

Table 1 is a matrix of cultural resources, potential fire program effects, and treatments for Saguaro National Park. Park staff and the park’s consulting archeologist developed the CRC by defining historic contexts and a list of cultural resource types that included elements and values at risk from fire to develop the matrix. This matrix considers historical, archeological, architectural, and cultural values developed with NPS cultural resources professionals at the Western Archeological Conservation Center (WACC). The cultural resources matrix is a working summary of resources and how the fire program should relate to them. It is a useful guide, both for planning and operations, for all who will be working with fire and cultural resources in the monument.

Staff looked at risk conditions/activities that might occur in the presence of fire and potential effects on specific resource types given the elements of the resource, surrounding environment, and geographic location. Once the resource types and risk conditions/activities were defined, the resource and fire management personnel used this information to determine what the fire management objectives were and what treatments should be used to preserve identified resource values. Out of this discussion a matrix was developed that defines historic contexts and resource types. When using this document to determine what the treatment should be for a resource type, staff and/or fire management personnel should first look at the historic context and resource type. Once this has been determined staff can refer to the matrix for treatment or prescriptions.

Summary Description of the Fire Management Units

The FMP outlines two Fire Management Units (FMUs) at Saguaro National Park.

FMU 1 lies above 4,000' covering four vegetation units: pine- oak woodland, pine- oak forest, ponderosa pine, and mixed conifer. In this FMU a variety of treatment options can be used. These include wildland fire use for resource benefit, prescribed fire, non- fire treatments such as thinning, and fire suppression. The cultural resources in this area include Manning Camp, a site on the National Register of Historic Places which is used to house the fire crew and fire ecology crew. Other sites include at least two stone chimneys, and several low visibility prehistoric artifact scatters.

Proposed fire treatments in this FMU are designed to protect Manning Camp specifically and other identified cultural resources in this FMU. Until adoption of the five year Burn Plan, fuel treatments receive park review and are routed to the WACC archeology staff who will complete the appropriate documents for compliance with section 106 of the National Historic Preservation Act (NHPA) of 1966 as amended. During wildland fire, maps showing the locations of the cultural resources and WACC staff are available to assist the SAGU fire staff.

FMU 2 lies below 4,000' elevation and is characterized by Sonoran Desert and Desert grassland. In this FMU all fires are suppressed. At this time no fuel treatments are planned for this FMU. Approximately 85 percent of the park's cultural resources lie below 4,000' in this FMU.

The archeological sites at Saguaro National Park span more than 8,000 years of prehistoric and historic- period occupation. The prehistoric sites are primarily Archaic and Hohokam artifact scatters with low surface visibility and expression. The artifact scatters represent villages, campsites, farmsteads, and stone quarries. Other prehistoric sites include rock art (petroglyphs and pictographs), rockshelters, and bedrock milling sites. The historic- period sites in this FMU include ranching sites, mining sites, lime kilns, CCC features, and historic- period trash scatters. The Freeman Homestead and Lime Kilns are on Arizona State Register of Historic Places. All of the sites in the Rincon Mountain District below 4,000' are contributing elements of the Rincon Mountain Foothills Archeological National Register District.

Given the lack of fuel loads in this FMU the only threat the cultural sites might incur would be from ground disturbance associated with fire suppression activities. However, the suppression activities outlined in the FMP for this FMU recommend non- ground- disturbing suppression tactics in the vicinity of archeological sites such as retardant drops, water drops, and hand fuel removal. Fire lines in this area are usually constructed by hand fuel removal rather than by digging.

Summary of the Park's Cultural Resources

Approximately 70 percent of the park has been surveyed for cultural resources including all of RMD below 4,000 feet which is the area of the park with the highest potential for archeological and historic- period sites. Approximately 500 archeological and historic- period sites have been recorded. Sample survey of the uplands at RMD has included the trails and developed campsite areas as well as areas where cultural resources might occur. Archeological survey at TMD has examined road and trail corridors, developed areas such as the park headquarters and picnic areas, as well as areas where ground disturbance has been proposed. In addition, archeological survey at TMD has been conducted in areas of previously recorded/reported sites and in areas where the location of sites seems likely.

As future plans are made for prescribed burns in the monument, NPS will conduct archeological inventories of the proposed burn area if necessary. Prescribed burns in FMU 2 are usually bounded by trails negating the need for ground disturbing activities. Most of the trails in FMU 2 have been surveyed for archeological resources and so in most cases additional survey will not be required. Burn plans will be reviewed for fire management strategies with regard to cultural resources, using the most up- to- date information available.

Archeological survey has been conducted in both FMUs at a level sufficient to discuss the potential impact of fire on cultural resources. Prehistoric resources are, for the most part, low visibility artifact scatters that represent campsites, quarries, agricultural sites and villages. Other prehistoric sites include rock art sites, rockshelters, and sites with bedrock grinding features. The greatest risk to these sites is ground disturbance such as construction of fire lines or trails. Most of the prehistoric sites occur in FMU 1 where all fires are suppressed but because of the nature of the fuels ground disturbing suppression activities are unlikely in FMU 1.

The historic resources of the park range from abandoned mining and ranching operations to lime kilns, and historic- period trash scatters. The fire risk to these sites lies in the few pieces constructed of combustible wood (which is quite rare) and in the possibility of ground disturbing activities such as fire lines and roads. Manning Camp is a unique historic resource at the park as the only standing historic structure that has been adapted to serve as the base for the park's high elevation fire camp.

Several cultural landscapes have been identified at the preliminary level (Level 0). A Saguaro Harvest Camp at TMD has been the location of saguaro fruit harvesting activities for several generations of Tohono O'Odham tribal members. The Civilian Conservation Corps- designed landscape includes patterns of spatial organization and circulation, construction and planting design principles, use of native materials, and a distinctive style of masonry characteristic of this period, with specific associated features including the picnic areas, the system of water control features such as stone dams and spillways, and stone retaining walls. The landscape also includes the remains of the actual CCC encampment with melted adobe structures and small-scale features. The Rincon Mountain Foothills Archeological District includes all of the archeological sites located below 4,000' in RMD. Other potential landscapes include Manning Camp; the Amole Mining District; the Freeman Homestead; the Lime- Making Industry; and several ethnographic landscapes. The risk of fire to all of these cultural landscapes is low.

Desired Conditions For Historic Properties

Desired Conditions for historic properties at Saguaro National Park have not been identified in previous plans or reports. However, archeological inventory forms produced between 1983 and 2003 and the List of Classified Structures inventory forms prepared in the mid 1990s specify the condition of historic properties in the monument. Most of the archeological site condition data are available in the Archeological Sites Management and Information System (ASMIS) data base available at WACC. Fire program activities are intended to maintain present condition and minimize impacts to cultural resources.

Recommended Treatments

Table 1 is the matrix that presents the types of resources present and the recommended treatments. This information is summarized here.

Treatments for Prehistoric Archeological Sites

The prehistoric sites are listed as five basic types in the table. For **prehistoric artifact scatters**, which include lithic scatters and quarries, the elements at risk are the artifacts and features that are present both above and below the ground. The distribution of the artifacts and features, known to archeologists as the context of these elements, could be put at risk by ground disturbing activities such as construction of fire lines, roads, and spike camps. However, because most of the prehistoric artifact scatters recorded at Saguaro National Park lie in FMU 1 where ground disturbance of this type is unlikely given the light fuel loads that find it difficult to carry fire, any fire suppression activity that does not involve ground disturbance is recommended. The light fuel load at these sites and the generally low temperatures of fires in this FMU also minimizes the risk to artifacts that might occur during fires that burn hot. The same set of conditions and recommendations can be applied to the **prehistoric agricultural sites** in the park, which are characterized by low visibility rock features and surface artifacts.

Rock art sites (paintings and petroglyphs), **rock shelter sites** and **bedrock mortar sites** are subject to many of the same risks and recommended treatments. The element at risk at these sites is integrity as represented by the art and by the midden deposits at the rockshelters. Risk conditions for rock art include fire, heat, sooting, and spalling. Add the risk of ground disturbance for the rockshelter sites. Bedrock mortars could be damaged by heat spalling. For all of the rock art, rockshelter and bedrock mortar sites fuel reduction is recommended if appropriate. However, in most cases at Saguaro National Park these sites are in open locations with low fuel loads. Although most suppression activities are appropriate suppression activities should *not* include applying cold liquids (water or retardant) to hot rock surfaces as this might cause spalling.

Treatments for Historic- Period Sites

The historic- period sites at Saguaro National Park include Manning Camp, the Freeman Homestead, ranches, lime kilns, the CCC constructed sites, and historic- period trash scatters. **Manning Camp**, listed on the National Register of Historic Places, is the location of the seasonal fire camp and, as such, receives constant and diligent attention including mechanical fuel reduction to prevent fire damage. Other measures such as the use of sprinklers and application of fire retardant fabric will be deployed as necessary. The **Freeman Homestead**, listed on the State Register of Historic Places, is the last homestead granted in the Tucson area and includes a melted adobe structure and a capped well. The tamarisk tree located next to the adobe structure is a contributing element of the property. The risk of fire to the site is low but suppression activities should avoid ground disturbance.

The **mining sites** have pits, shafts, adits, the remains of structures and historic- period trash deposits. The park has fenced the dangerous openings at these sites. The sites are located in rugged terrain and are at low risk from all fire management activities. The **ranching sites** at Saguaro National Park include features such as windmills, corrals, fences, ruined structures, and historic- period trash deposits. All suppression activities are appropriate at these sites. The **lime- kiln sites**, scattered throughout both districts in FMU 1, were built to withstand the effects of fire. However, the ruined state of the kilns and their location along drainages has made them vulnerable to erosion and other types of ground disturbance. A program of mechanical fuel reduction may be needed. All fire suppression activities appropriate in FMU 1 can be used in the vicinity of the kilns.

The CCC sites include picnic areas, a system of water control features such as stone dams and spillways, and stone retaining walls throughout FMU 1. Most of these features are not at risk from the types of fire suppression used in FMU 1. The CCC picnic areas include masonry features with wooden components that are at risk from fire. All suppression activities are appropriate at the picnic areas and mechanical fuel reduction should be used as necessary. **Historic-period trash scatters** located throughout the park are at little risk from fire or suppression activities. Their significance lies in the location and context of the artifacts so ground disturbance should be avoided.

Treatment for Cultural Landscapes

The potential cultural landscapes identified at Saguaro National Park include **ethnographic landscapes**, that is areas of the park that may have importance to Native American tribes. Formal consultation with the park's consulting tribes will be necessary to identify the potential impact of the fire plan - - both fire treatment and suppression activities - - on ethnographic landscapes. A known ethnographic landscape at the park is a **saguaro cactus harvest camp** located in FMU 2 at TMD. The wooden structures and other features at the site are at risk from fire but there is a low risk of wildfire in this FMU. All suppression activities would be appropriate. The **Civilian Conservation Corps landscape** includes the picnic areas with masonry features that have wooden components that are at risk from fire. All suppression activities are appropriate and mechanical fuel reduction should be used as necessary at the CCC sites. Other potential landscapes include **Manning Camp**, the **Freeman Homestead**, the **Amole Mining District** and the **Lime- Making Industry**. The treatments recommended for these sites, that is, mechanical fuel reduction and all suppression activities except ground disturbance, are also appropriate for these landscapes.

The **Rincon Mountain Foothills Archeological District landscape** includes all of the archeological sites located below 4,000' in RMD. All suppression activities except those involving ground disturbance are appropriate.

Agency Review Procedures

The CRC for the Saguaro National Park FMP will undergo review by the Arizona SHPO at such time that the five- year burn plan for the park is completed. The CRC will be revised to address the five- year burn plan and the SHPO will be asked to concur in a finding of no effect or no adverse effect if such a finding is appropriate.

Consultation with Indian Tribes and the Public

For fuels management undertakings and for the five- year burn plan consultation with Indian tribes and the public will be conducted. The park has already identified associated tribes which include the Tohono O'Odham Nation, the Gila River Indian Community, the Salt River Pima-Maricopa Indian Community, the Fort McDowell Mohave- Apache Indian Community, the Pascua Yaqui Tribe, and the Hopi Tribe. It is the park's plan to notify tribes and public by letter of action; allow at least 30 days for response to letter; schedule Tribal consultation or public meetings if necessary; address concerns raised by tribes and public; and keep a draft letter on file and notify neighbors, tribes, local government offices, and other interested parties in a timely manner.

Fuels Management Undertakings

In the absence of a five- year plan the park will continue to use the Project Review Form which includes consideration of impact to cultural resources. Submission of the review form to WACC leads to the preparation of no effect clearances or no adverse effect compliance documents for each proposed action. The park proposes to prepare a single compliance document for the five- year fire plan. Fire year plan also will include Native American consultation with affiliated/consulting tribes.

Discoveries

When unrecorded cultural resources are discovered contact the park’s CR advisor at WACC or the CR advisor who is part of a fire management team. Generally speaking an archeologist will visit the site and record it when the conditions allow.

Professional Qualifications

Archeologists and other cultural resource professionals called on to assist Saguaro National Park with fire planning or during fire incidents must meet the Secretary of Interior’s Professional Qualification Standards as listed in Director’s Order 28. Ideally, a complete analysis of the effects of fire projects on cultural resources requires the professional services of an archeologist, ethnographer, landscape architect, architectural historian, and historian, each of whom meets the Secretary of the Interior’s Professional Qualifications Standards. It is the responsibility of the Superintendent to identify those professionals when they are needed. The park has sought the assistance of the Western Archeological Conservation Center and its own staff to prepare this document. The draft CRC prepared for Chiricahua National Monument by Gebow and Harper (2003) has been used as the model for this CRC.

Summary of Actions

This list, Table 2, adapted from the Draft Chiricahua National Monument CRC (Gebow and Harper 2003), is a good summary of actions for planning and appropriate responses to fire incidents.

Table 2

Summary of Actions Recommended for Cultural Resources When Planning or Responding to Fire Management Undertakings

<p>Planning protocols</p> <ul style="list-style-type: none"> <input type="checkbox"/> Determine affected area and resources. <input type="checkbox"/> Survey if needed. <input type="checkbox"/> Superintendent calls in professionals from outside park if needed. <input type="checkbox"/> Superintendent consults with other agencies if needed.
<p>Undertaking information</p> <ul style="list-style-type: none"> <input type="checkbox"/> Discuss proposed action within park (fire and cultural resource managers). <input type="checkbox"/> Communicate survey needs in writing. <input type="checkbox"/> Use matrix (Table 1) to predict direct (within project boundary) and indirect (outside project boundary) effects.

<p>Records and literature search</p> <ul style="list-style-type: none"> ❑ Site records and archeological survey maps are on file at WACC. ❑ A cultural resource GIS component is being prepared by WACC that will be a useful tool for fire management. ❑ When more information is needed beyond that provided in the CRC, consult park, local, and agency records and experts.
<p>Consultation with Indian tribes and the public</p> <ul style="list-style-type: none"> ❑ Associated tribes have been identified. ❑ Notify tribes and public by letter of action. ❑ Address concerns raised by tribes and public. ❑ Allow at least 30 days for response to letter. Schedule Tribal consultation or public meetings if necessary. ❑ Keep a draft letter on file and notify neighbors, tribes, local government offices, and other interested parties in a timely manner.
<p>Evaluating Impacts to Cultural Resource</p> <ul style="list-style-type: none"> ❑ Use cultural resources matrix in this documents. ❑ Determine area of effect. ❑ Review survey results.
<p>Determining Effects</p> <ul style="list-style-type: none"> ❑ Determine direct effects prior to initiating project. ❑ Determine indirect effects. ❑ Decide acceptable impacts. ❑ Implement pre- project protection measures. ❑ Assess actual impacts after project completion.
<p>Treatment measures (see matrix, Table 1)</p> <ul style="list-style-type: none"> ❑ Identify treatments that avoid, minimize, and mitigate unacceptable impacts. ❑ Justify treatments relative to the state of the art. ❑ Ensure that the cure is not worse than the disease. ❑ Superintendent identifies proper professionals when outside assistance needed.
<p>Monitoring (When needed)</p> <ul style="list-style-type: none"> ❑ Define resources to monitor. ❑ Determine duration and frequency of monitoring. ❑ Determine appropriate professionals to complete monitoring. ❑ Duration and frequency will vary with resource type, location, and intensity of burn
<p>Experimentation (When feasible)</p> <ul style="list-style-type: none"> ❑ Determine opportunities to test and compare cultural resource protection methods. ❑ Inform interested professionals. ❑ Review results. ❑ Can compare effectiveness of thinning, fire lines, different burn seasons, retardant
<p>Unanticipated Effects</p> <ul style="list-style-type: none"> ❑ Superintendent contact professionals from WACC and SOAR. ❑ Determine impacts.

<ul style="list-style-type: none"> ❑ Minimize continued impacts. ❑ Predict future impacts and recommend minimization measures. ❑ Implement minimization measures.
<p>Cultural Resource Discoveries</p> <ul style="list-style-type: none"> ❑ Arrange to survey previously unidentified cultural resources ❑ Superintendent report discoveries to WACC and SOAR. ❑ Follow Sections 106 and 110 of NHPA. ❑ Use matrix (Table 1) to predict impacts and decide treatments.
<p>BAR</p> <ul style="list-style-type: none"> ❑ Superintendent contact WACC and SOAR if external assistance is needed. ❑ Submit funding proposal to Burned Area Rehabilitation program through IMRO if necessary.
<p>Agency Review Process</p> <ul style="list-style-type: none"> ❑ Agency review (internal and external) is interwoven into all project planning areas and steps. ❑ Consult as early as possible when needed during planning stages ❑ Consult and update in a timely manner when needed.

Table 1: Saguaro National Park Cultural Resources Matrix

Historic Context	Resource Type	Elements	Elements or Values at Risk	Risk Conditions	Management Goals	Treatments Objectives
Prehistoric Sites	Artifact Scatter/Lithic Scatter/Quarry	Artifacts and features	Distribution of the artifacts above and below the ground	Ground disturbance	Avoid ground disturbance	Any suppression activities EXCEPT ground disturbance
	Agricultural sites	Rock features and artifacts	Integrity of features and distribution of artifacts	Ground disturbance	Avoid ground disturbance	Any suppression activities EXCEPT ground disturbance
	Rock Art	Paintings and Petroglyphs	Integrity and visibility	Fire, heat, sooting, spalling	Mechanically reduce fuels if appropriate.	Most suppression activities are appropriate. Avoid applying cold liquids (water or retardant) to hot rock surfaces.
	Rock Shelters	Subsurface deposits, rock art	Integrity of cultural deposits	Ground disturbance, fire, heat, sooting	Mechanically reduce fuels if appropriate	Most suppression activities are appropriate. Avoid applying cold liquids (water or retardant) to hot rock surfaces.

Historic Context	Resource Type	Elements	Elements or Values at Risk	Risk Conditions	Management Goals	Treatments Objectives
	Bedrock Mortars	Bedrock Mortars	Little risk from fire	Spalling	Mechanically reduce fuels if appropriate	Most suppression activities are appropriate. Avoid applying cold liquids (water or retardant) to hot rock surfaces.
Historic-Period Sites	Manning Camp	Cabin, Corral, Landscape	Cabin and Landscape	Cabin could be destroyed by fire	Maintain historic cabin and landscape	Any suppression activity
Historic-Period Sites (Continued)	Freeman Homestead	Melted Adobe Structure, Well, Tamarisk Tree	Features and landscape	Ground disturbance	Avoid ground disturbance	Any suppression activities EXCEPT ground disturbance
	Mining Sites	Pits, Shafts, Adits, Trash, Ruined Structures	Historical trash deposits and wooden elements	Low risk	Maintain historic appearance	Any suppression activity
	Ranching Sites	Structures, Fence Posts, Corrals, Windmills, Trash	Historical trash deposits and wooden elements	Low risk	Maintain historic appearance	Any suppression activity
	Lime Kilns	Lime Kilns, Waste Piles	Integrity of kilns and Landscape	Erosion, ground disturbance	Mechanically reduce fuels if appropriate; avoid ground disturbance	Any suppression activities EXCEPT ground disturbance

Historic Context	Resource Type	Elements	Elements or Values at Risk	Risk Conditions	Management Goals	Treatments Objectives
	CCC Sites	Picnic Areas, Camp, Check Dams, Walls	Wooden components of masonry features and landscape	Loss of original wood components	Mechanically reduce fuels if appropriate	Any suppression activity
	Historic- Period Trash Scatters	Historic- Period Trash Deposits	Integrity of the deposit	Low risk	Avoid ground disturbance	Any suppression activity
Landscapes	Saguaro Harvest Camp	Ramadas, Fences, Features and Artifacts	Integrity of the site and landscape	Wooden structures, features and artifacts	Mechanically reduce fuels if appropriate	Any suppression activity
	Ethnographic Landscapes	To be determined through consultation	To be determined through consultation	To be determined through consultation	To be determined through consultation	To be determined through consultation
	Potential Landscapes: CCC, Manning Camp, Freeman Homestead, Amole Mining District, Lime Making Industry Landscapes	See above under Historic- Period Sites	See above under Historic- Period Sites	See above under Historic- Period Sites	See above under Historic- Period Sites	See above under Historic- Period Sites
Landscapes (Continued)	Rincon Mountain Foothills Archeological District Landscape	Archeological sites and their distribution across the landscape	Integrity of the sites	See individual site types above under Prehistoric Sites	See individual site types above under Prehistoric Sites	See individual site types above under Prehistoric Sites

APPENDIX 3
NATIONAL PARK SERVICE
SAGUARO NATIONAL PARK
FIRE EFFECTS AND FIRE MONITORING PLAN
2003
Prepared by: Kathy Schon, Fire Ecologist

Saguaro National Park Fire Effects And Fire Monitoring Plan

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I - INTRODUCTION

The Federal government manages a variety of ecosystems across the United States, including deserts, grasslands, tundra, shrublands, forestlands, estuaries, and riparian zones. These ecosystems range from arid to humid, warm to cold, and sea level to over 10,000 feet elevation. Fires naturally occur in almost all of these ecosystems, with fire characteristics determined by climate, vegetation, and terrain.

The basic goals of the management policies at Saguaro National Park (SAGU) are the protection and perpetuation of naturally operating ecosystems to the fullest extent consistent with safeguarding public safety, cultural resources and private property. Fire acts as one of the natural conditions influencing these ecosystems and consequently fire must be managed so that it can assume its natural role through the full range of wildland fire use and/or prescribed fire.

To manage fire effectively resource managers today need a great deal more monitoring information on the physical, biological, and ecological effects as well as the socio- political factors of fire. They will need information on fire behavior and fire effects as a basis for analyzing the benefits, damages, and values of various fire management alternatives. There are four monitoring levels identified in this plan. These levels are cumulative and include:

- Level 1, Environmental - This level provides a basic overview of the baseline data collected prior to a prescribed fire. Information at this level includes such items as historical weather, topography, and socio- political factors. This level of monitoring is required for each prescribed fire and each wildland fire for resource benefit.
- Level 2, Fire Observations - This level documents fire observations during wildland and prescribed fires. Information at this level includes characteristics of fire, such as rate of spread and flame length, as well as current weather conditions. This level of monitoring is required for each prescribed fire and each wildland fire for resource benefit.
- Level 3, Short- term Change – This level should be used to monitor effects of prescribed fire; however, it may also be used for mechanical treatments and wildland fire for resource benefits. It is not necessary to install monitoring plots on each burn unit. Rather, a network of plots should be established for each monitoring type where prescribed fire is planned. This network of plots should be designed to measure fire effects in the monitoring type at acceptable precision and confidence levels (see Fire Monitoring Handbook <http://fire.nifc.nps.gov/fmh>). Information collected at this level is based upon management objectives, and includes changes within specific vegetation and fuels.
- Level 4, Long- term Change – This level should be used to monitor effects of prescribed fire; however, it may also be used for mechanical treatments and wildland fire for resource benefits. It is not necessary to install monitoring plots on each burn unit. Rather, a network of plots should be established for each monitoring type where prescribed fire is planned. This network of plots should be designed to measure fire effects in the monitoring type at acceptable precision and confidence levels (see Fire Monitoring Handbook). Information collected at this level includes monitoring of the variables selected for short- term monitoring sampled over a longer period of time. This monitoring level concentrates on identification of significant trends that guide management decisions.

II - ASSUMPTIONS

Ecosystems have evolved with, and adapted to, specific fire regimes. In a particular ecosystem, natural fires occurred with fairly specific, albeit irregular, frequency and typical season of occurrence; with characteristic fireline intensity and severity; and characteristically did or did not involve the crowns of trees or shrubs. Gross differences occurred among ecosystems. For example, frequent, low intensity, surface fires were common in ponderosa pine ecosystems, whereas fires in big sagebrush were probably less frequent, of higher intensity, and killed much of the sagebrush overstory. High intensity, stand replacement fires at long intervals were characteristic of some forest types, while annual fires may have been common on some Great Plains grasslands (Clark and Miller 1994). Despite this variability in fire regimes, universal principles and processes govern response of ecosystem components to fire. Recognition and understanding of the principles and processes can help our understanding of the variability in post fire effects that is often reported in the literature, and differences between reported results and local observations on burned areas. This knowledge will enable resource and fire managers to predict and evaluate fire effects, regardless of ecosystem or fire regime.

Fire effects are the result of an interaction between the heat regime created by the fire and the properties of ecosystem components present on the site. For example, plant species in vegetation types that have evolved with frequent fire tend to be much more resistant to fire than species from plant communities that rarely burned. The effects of a fire burning under the same conditions may be very different on soils of different textures or chemical properties. Variation in fire effects may also occur within ecosystems because of differences in site characteristics, fuel conditions, and weather prior to, during, and after the fire. A fire may have different effects upon the same site if it occurs in different seasons or within the same season but with different fuel, duff, soil moisture, and fuel temperature. For these reasons, it is important to document conditions under which the fire occurred, and the characteristics of the fire, as part of any effort to monitor post fire effects.

We recognize that a natural fire regime cannot be immediately perpetuated in unnatural communities. Degree of use, the accidental or deliberate introduction of exotic plants and animals, and other cultural activities that alter fuel continuity and loading, and the modification of historic fire patterns through active suppression have changed many plant communities. In addition, Saguaro National Park exists as a refuge for small populations of plant and animal species that have become rare or extirpated outside of the park boundaries as the result of major environmental changes in the Tucson Basin. Therefore, fire management decisions on a landscape scale must sometimes be modified in order to preserve these small populations

Lastly it is important to note that this plan is a “living” document. That is, as we learn more, our objectives and methods may change. The plan will be updated annually or as needed to account for these changes.

III - FIRE MONITORING GOALS

- a) Verify that prescribed fire program objectives and goals are being met through documentation and analysis of fire effects data and using the data to determine if changes in burn prescriptions are needed.

- b) To perpetuate a working relationship between fire management and resource management in the developing of fire monitoring goals.
- c) Increase knowledge of fire behavior and effects on the park's ecosystems.
- d) Adhere to standardized data collection techniques for FMH plots.
- e) Document fire behavior and weather data for all prescribed fires and wildland fires and keep all data organized and accessible.
- f) Identify areas in which research/monitoring should be initiated.
- g) Provide historic and administrative data for fires within the park.

IV - DESCRIPTION OF ECOLOGICAL MODELS

Overall Description of Vegetation/Zones, General Response to Fire, Fire History, and/or Special Concerns

Rincon Mountain District:

Low elevation desert scrub gives way upslope to desert grassland, which in turn interdigitates with pine- oak woodland. Pine- oak woodland gives way to pine- oak forest, which then gives way to pine forests. The addition and loss of elevation from 3000 to 8600 feet is gradual, leading to many shared species between adjacent associations. Small areas of mixed conifer forest occupy north- facing slopes at high elevations. Riparian forest and riparian woodland occur locally in canyon bottoms. Wet and dry meadows are found in scattered clearings at high elevations, the former around springs, the latter often on old burns or disturbed sites.

Tucson Mountain District:

Many of the same vegetation communities are found in the Tucson Mountains as seen in the Rincons; however, because the Tucson Mountains do not reach the same elevation of the Rincons, a number of the higher- elevation plant communities are lacking.

Vegetation Zones:

- Mountain Wet Meadow – occurs near springs from 7400 to 8000 feet. Dominants are largely various Cyperaceae, Poaceae and Juncaceae.
 - Currently, there are no Fire Effects Monitoring Plots in this Zone.
- Mountain Dry Meadow – occurs at 8500 feet. Grasses, including *Muhlenbergia*, *Blepharoneuron*, *Bromus*, *Agrostis*, *Stipa*, and *Poa* dominate this association. Many annual forbs and *Pteridium aquilinum* can also be found in this association along with *Dugaldia hoopesii*.
 - Currently, there are no Fire Effects Monitoring Plots in this Zone.
- Mixed Conifer Forest – occurs from 7000 to 8000 feet. *Pseudotsuga menziesii* is the dominant in the overstory, with *Pinus ponderosa*, *Pinus strobiformis*, *Quercus gambelii*, *Robina neomexicana* and *Abies concolor* as subdominants. On the north slopes of Mica Mountain, the canopy is closed with low branches draped with lichen. On the North Slope of Rincon Peak, the association is frequently patchy with open areas dominated by herbs. The shrub layer consists of patches of *Symphoricarpos*

- oreophilus* with scattered *Holodiscus dumosus*, *Lonicera arizonica* and *Rubus neomexicanus*. *Ptelea trifoliata* is locally abundant in the shrub layer on Rincon Peak.
- Currently, there are ten fire effects monitoring plots in this Zone. Their Monitoring Type Code (a code assigned to a group of plots related in species composition, fuel model and burn prescription) is FPSMErTio
- Pine Forest – occurs from 8000 to 8600 feet. *Pinus ponderosa* is the dominant in the overstory, with *Pinus strobiformis* and *Quercus gambelii* as subdominants. The shrub layer is composed of scattered *Symphoricarpos oreophilus*, *Holodiscus dumosus*, *Lonicera arizonica* and *Ceanothus fendleri*. Dominant herbs and grasses are *Muhlenbergia virescens*, *Carex geophylla*, *Dugaldia hoopsii* and *Senecio wootonii*.
 - Currently there are twenty- eight fire effects monitoring plots in this Zone. Their Monitoring Type Codes are FPIPOrT09 and FPIPOrGo9
 - Pine- Oak Forest – occurs from 5300 to 8000 feet. This association is the most variable at the higher elevations in the Rincon Mountains and covers a wider elevational belt than any other forest or woodland association in the range. Pine- oak forest blends into pine forest at its upper elevational limit and into pine- oak woodland at its lower elevational limit. It can be distinguished from either of these by the larger number of *Quercus* species and by the presence of *Pinus leiphylla* (there are areas without *Pinus leiphylla* higher in elevation that are still considered part of this association). Trees in the pine forest are typically greater than 80 feet tall and pine- oak woodland are less than 20 feet tall; pine- oak forest is intermediate between the two. Tree species include; *Pinus ponderosa*, *Pinus strobiformis*, *Pinus leiophylla*, *Pinus cembroides*, *Quercus rugosa*, *Quercus arizonica*, *Quercus hypoleucoides*, *Juniperus deppeana*, *Arbutus arizonica* and *Quercus emoryi*. The shrub layer varies in species and density depending on elevation. At higher elevations *Symphoricarpos oreophilus*, *Berberis wilcoxii*, *Yucca schottii*, *Rubus neomexicanus*, *Ceanothus fendleri* and *Rhamnus californicus* occur. Lower in elevation *Arctostaphylos pungens* and *pringlei*, *Rhamnus betulifolia*, *Acacia angustissima*, *Nolina microcarpa*, *Mimosa biuncifera* and *Garrya wrightii* occur. The understory is poorly developed where the canopy is dense but richer in species and density where the canopy is open. Grasses include *Muhlenbergia virescens*, *Poa fendleriana*, *Koeleria cristata*, *Panicum bulbosum*, *Blepharoneuron tricholepis*, *Elymus arizonicus*, *Stipa pringlei* and *Piptochaetium fembratum*.
 - Currently there are twenty- three fire effects plots in this Zone. Their Monitoring Type Codes are FQUARrT09, FPILErT04 and FQUHYrT09
 - Pine- Oak Woodland – occurs from 4400 to 6100 feet. The trees often form an open woodland 10 to 20 feet in height, but at some locations the association becomes chaparral- like. *Quercus emoryi* and *Quercus arizonica* dominate at the lower elevational limits. *Juniperus deppeana* and *Pinus cembroides* gain dominance with increasing elevation. The shrub layer is frequently very dense, and is composed of *Arctostaphylos pungens* and *pringlei*, *Garrya wrightii*, *Yucca schottii*, *Nolina microcarpa*, several *Opuntia* and *Agave* species and *Mimosa biuncifera*. The understory is rich in herbs and grasses at lower elevations and decreases with increasing elevation and canopy closure. Grasses include many species of *Muhlenbergia*, *Stipa*, *Eragrostis*, and *Bouteloua* to name a few.

- Currently there are ten fire effects plots in this type. Their Monitoring Type Codes are FQUARITo6.
- Desert Grassland – occur from 4000 to 5000 feet. There are several small patches that are slowly being encroached by shrub and tree species. These patches vary greatly in species composition but is characterized by the presence of numerous perennial grasses. The most common are; *Heteropogon contortus*, *Bouteloua curtipendula/radicosa/hirsuta/repens*, *Eragrostis intermedia/lehmanniana*, *Diplachne dubia*, *Bothriochloa barbinodis*, *Muhlenbergia emersleyi*, *Schizachyrium cirratum*, *Trachypogon secundus*, *Lycurus setosus*, *Hilaria belangeri*, *Digitaria californica* and *Elyonurus barbiculmis*. Shrubs, cacti, succulents and trees include; *Fouquieria splendens*, *Vauquelinia californica*, *Agave schottii*, *Dasyilirion wheeleri*, *Nolina microcarpa*, *Opuntia versicolor/phaeacantha*, *Aloysia wrightii*, *Mimosa buincifera*, *Calliandra eriophylla*, *Bouvardia ternifolia*, *Gossypium thurberi*, *Eysenhardtia orthocarpa*, *Erigonum wrightii*, *Asclepias linaria*, *Erthrina flabelliformis*, *Agave palmeri*, *Brickellia venosa*, *Ericameria laricifolia*, *Jatropha cardiophylla*, *Prosopis velutina*, *Quercus oblongifolia*, *Juniperus deppeana/erythrocarpa*, *Mammillaria grahamsi* var. *olivaei*, *coryphantha vivipara* var. *bisbeeana* and *mammillaria heyderi* var. *macdougalii*.
 - Currently, there are no Fire Effects Monitoring Plots in this Zone.
- Desertscrub – occurs from the base of the mountain to about 5200 feet and is characterized by the large number of cacti and by the drought- deciduous habit of many of the trees and shrubs. Dominants in the overstory include; *Parkinsonia microphylla*, *Carnegiea gigantea*, *Fouquieria splendens* and *Prosopis velutina*. *Commun understory plants are; Ambrosia deltoidea, Encelia farinosa, Opuntia versicolor/phaeacantha/leptocaulis/arbuscula, Mammillaria microcarpa, Ferocactus wislizenii, ConDALIA warnockii, Lycium berlandiere, Celtis pallida, Larria tridentata, Jatropha cardiphylla, Acacia constricta/greggii* and *Calliandra eriophylla*.
 - Currently, there are no Fire Effects Monitoring Plots in this Zone.
- Riparian Woodland and Riparian Forest – Riparian forest occurs at high elevations and is characterized by *Alnus oblongifolia*, *Acer negundo* and *Salix exigua*. Riparian woodland is highly variable in species composition. It typically supports not only riparian species but species normally found at higher elevations. Dominance is shared by a number of species; *Platanus wrightii*, *Salix gooddingii/irrorata*, *Fraxinus velutina*, *Alnus oblongifolia*, *Juglans major*, *Quercus arizonica*, *Populus fremontii* and *Juniperus deppeana*. The understory varies depending on water availability and denseness of canopy. *Juncaceae*, *Cyperaceae* and *Poaceae* species are common.
 - Currently, there are no Fire Effects Monitoring Plots in this Zone.

V - LEVEL 1 MONITORING

Level 1, or, environmental monitoring provides a basic overview of the baseline data collected prior to a prescribed fire. Information at this level includes such items as historical weather, topography, and socio- political factors. This level of monitoring is required for each prescribed fire and each wildland fire for resource benefit.

This data is gathered by the Fuels Specialist and Fire Management Officer (FMO) and is presented in each burn plan for the specific burn area. General historic weather data is located on the FMO's computer. GIS data layers (such as topography) are located on the Park's N drive at N:\GPS\Arcview Shapefiles.

VI -LEVEL 2 MONITORING

Level 2, or, fire observation monitoring documents fire observations during wildland and prescribed fires. Information at this level includes characteristics of fire, such as rate of spread and flame length, as well as current weather conditions. This level of monitoring is required for each prescribed fire and each wildland fire for resource benefit.

The Fire Effects Crew, at a frequency determined by the Burn Boss, will collect fire weather and behavior data during all scheduled prescribed burns. This data is recorded on the weather observation form and the fire behavior observation form. Upon completion of the Burn, a burn summary report will be completed by the lead fire effects monitor which includes all weather, behavior, and smoke data taken along with a summary of each day's activities.

For all wildland fires in the park the fire behavior and weather data will be taken by whomever the I.C. determines most appropriate. The frequency on which data will be taken will depend on the fire activity and fuel type. Fire effects monitoring on wildland fires will be determined by the Fire Ecologist and a Resource Specialist and will be carried out by the fire effects crew with approval from the regional fire ecologist. Data will be collected, analyzed and reported in a timely and efficient manner.

VII - LEVELS 3 & 4 MONITORING

SAGU has implemented a prescribed fire plan to decrease fuel loads and increase biological diversity while attempting to slowly bring back the historic fire regime. We measure our results using biological fire effects plots, which allow us to follow trends and analyze our objectives with concrete data to determine if our prescriptions are meeting our objectives. This process is the short and long term monitoring, or monitoring levels 3 and 4.

SAGU has installed 70 permanent fire effects monitoring plots (Figure 1) in six monitoring types (see Appendix A for descriptions of monitoring types) and 8 permanent photo points in the 1999 Box Canyon wildland fire for resource benefit. SAGU burned the first 5 fire effects plots in 1993 during the 100- acre Duckbill prescribed fire. Since then 33 more plots have burned in the park for a total of 38 burned fire effects monitoring plots and 32 unburned in 6 vegetation types.

SAGU has adopted the National Fire Monitoring Handbook (FMH) as the general methodology used for fire effects plots. Specific protocols that deviate from FMH are located on the park network at N:\GPS\Fire\Ecology\Cookbook

The Western Region Fire Monitoring Handbook was developed to facilitate and standardize monitoring for all National Park Service units that are subject to burning by wildland or prescribed fire. Levels of monitoring activity are established and defined relative to fire and resource management objectives and fire management strategies. For more information about FMH visit <http://fire.nifc.nps.gov/fmh>.

The purpose of this section is to document fire effects monitoring at SAGU as it stands in the year 2003 so that managers and new employees can have a better understanding of how the program works. This section will also provide some insight as to the direction of the program over the next few years, as well as documentation of changes in protocols. The effect of fire on wildlife is inextricable from its effects on vegetation, and is therefore also extremely complex, highly variable and difficult to predict. The aim of the fire effects program is to study the structural framework of wildlife habitat not wildlife. Thus, wildlife will not be directly discussed in detail in this plan. However, an assumption of the plan is that fire will not result in the extirpation of native animal species from the Park, or adversely effect species of special status such as Mexican spotted owls.

Management and Monitoring Objectives By Monitoring Type

Management and Monitoring objectives can be found in Appendix A (Monitoring Type Descriptions) below the prescription information.

Program Information

i. Field Sampling & Quality Control

The Western Region Fire Monitoring Handbook should be referred to for general, detailed data gathering techniques (see web site <http://fire.nifc.nps.gov/fmh>). Appendix A and the Fire Effects Cookbook located on the Parks network at N:\GPS\Fire\Ecology\Cookbook should be consulted for specific protocols on Saguaro’s monitoring design that deviate from the FMH handbook, or where further explanation seemed necessary, and for quality control

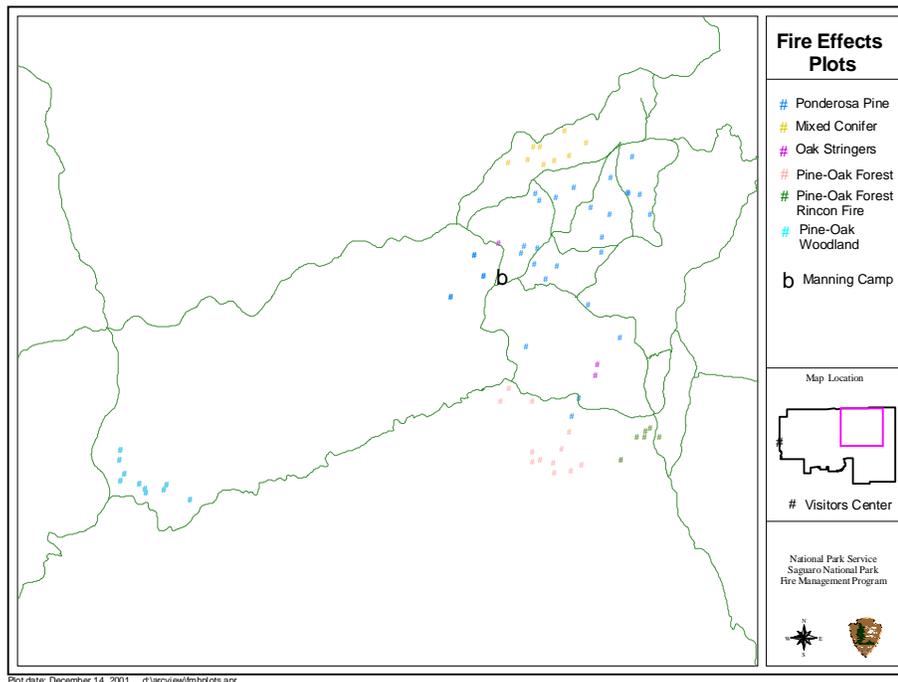


Figure 1. Saguaro National Park Fire Effects Plots December 14, 2001

tips for the field. Data forms are located on the park network at N:\GPS\Fire\Ecology\Forms.

2. Timing

Due to the number of plots that SAGU has and the climate of Southern Arizona plots can not always be read at the best phenological time for the associated vegetation. The best time for all vegetation types is generally post Monsoon. Since this is not possible in all cases, our goal is to be consistent from year to year. Check the pre- burn data on each plot to determine what time of year it was initially read and read it at that time until the next burning cycle. Each plot is read pre- burn, immediate post burn, one year post, two year post, five years post burn, and ten years post unless a second entry burn is initiated before, in which case the process begins again with pre- burn.

3. Plot Relocation

Each plot will be GPSed along with detailed hand written directions (all GPS data to this point is in NAD 27. NPS is moving toward using NAD83. Until SAGU's GIS specialist can transfer the park's data layers to NAD 83, we should continue to use NAD 27). GPS coordinates will be written on the Index Plot Location Data Sheet along with the GPS file name. Points will then be downloaded and converted into Arcview shapefiles. These shapefiles will be stored on the N Drive at N:\GPS\Fire\Ecology\Plot Points.

4. Information Management & Quality Control

Data will be entered and analyzed using the National Park Service's Fire Monitoring Handbook software and a stem density spreadsheet on Excel. There are several steps that must be taken when entering and storing FMH data. The process can be complicated when data is being entered on several computers. See N:\GPS\Fire\Ecology\Cookbook for quality control and specific data management techniques for Saguaro. For data management forms go to N:\GPS\Fire\Ecology\Forms.

5. Data Analysis Approach

At this time, all the data is analyzed using the FMH software except for in the pine- oak woodland. Pine- oak woodland trees are analyzed using an Excel spreadsheet as the FMH software does not allow for stem density analysis. The Intermountain region is currently investigating a statistical software package that all parks will adopt for the fire effects program. This software will allow us to do more in- depth analysis.

Data analysis will occur throughout the year. However, an annual summary of data findings will be presented to the park staff and the region on an annual basis. The report to the region will be completed in December of each year. The report to park staff will be presented by the local Fire Ecologist prior to the next year's field season.

It is important to note that species response to fire depends on the interaction of individual life cycles, the fire regime, and the post- fire environment (Trabaud 1987). It is also

important to remember that plant communities are dynamic assemblages of populations of plant species coexisting in a given site. Factors that influence plant communities fall into five major categories: species characteristics, biotic interactions, resource availability, environmental heterogeneity, and disturbance (Harper 1977, Huston 1994). None of these elements are mutually exclusive. Thus, when analyzing the fire effects data we must keep in mind that fire is only one variable affecting the changes we see.

If, during analysis of the fire effects monitoring data, trends are observed that warrant further investigation, it will be up to the fire ecologist and the Division of Science and Resource Management to develop a research proposal for further investigation.

6. Funding

- Pre, During and post read plots will be billed to the project account.
- Travel and overtime while visiting other parks will come from that parks account.
- FIREPRO funding will cover all other monitoring activities, supplies and equipment.

7. Responsible party

Fire Ecologist: Data analysis, annual reports on fire effects data, presenting results, identifying research needs, working with Resource Management to fund and staff identified research and identify concerns and monitoring efforts during wildland fires. Responsible for the overall management of, and quality control of, the fire effects and fire monitoring program.

Assistant Fire Effects Manager: Lead biologist for the fire effects and fire monitoring crew. Day to day quality Control. All aspects of fire effects field management. Day to day supervision of the fire effects crew.

Fuels Specialist, Fire Management Officer, and Resource Specialist: Writes burn plans, prepares prescriptions based on resource objectives, reviews fire effects data to determine if prescriptions are meeting objectives.

Resource Specialist and Fire Ecologist: Determine appropriate fire effects monitoring activities for all wildland fires.

8. Equipment Vendors

Tree and Rebar tags:

National Band and Tag Company
721 York St/P.O. Box 430
Newport KY 41072- 0430
(606) 261- TAGS

Photo/Slide Development:

Photographic Works
3550 E. Grant
Tucson, AZ 85716

(520) 327- 7291

Field Equipment:

Forestry Suppliers
1- 800- 647- 5368

Rebar, Paint, Nails, tools:

Home Depot
7102 E. Broadway
Tucson
(520) 721- 8163

LITERATURE CITATIONS (cited in this plan* or recommended reading for fire history/ecology and plant community information)

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Bowers, J.E. and S.P. McLaughlin. 1987. Flora and Vegetation of The Rincon Mountains, Pima County, Arizona. University of Arizona at the Boyce Thompson Southwestern Arboretum.

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Martin, S.C. 1975. Ecology and management of southwest semidesert grass- shrub ranges: the status of our knowledge. U.S. Department of Agriculture, Forest Service General Technical Report RM- GTR- 156.

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Neary, L.S. Allen and R.H. Hamre. Effects of Fire on Madrean Province Ecosystems – A Symposium Proceedings. Pp. 15- 36. USDA Forest Service, RM- GTR- 289.

*Trabaud, L. 1987. Fire and Survival traits of plants. In: L. Trabaud. *The Role of Fire in Ecological Systems*. Pp. 65- 89. SBBA Academic publishing, The Hague.

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FMH- 4 Monitoring Type Protocols FMH Data - SAGU
FMH version 3.10, Printed on 11/16/01, 2:26:34 p.m.

Current directory: D:\FMHFINAL\SAGU
 Found on the NT Desktop, Fire Effects
 Last update: 11- 18- 01

----- Description -----

Monitoring Type Code: FQUARIT06 **Date Described:** 05/01/98

Monitoring Type Name: Pine/Oak Woodland

Preparer: Schon, Anderson, Anderson

FGDC Association:

FMH- 4 Version Title/Description: Version one

Visits Assigned: 00 PRE, 01 Post, 01 YR01, 01 YR02

Burn Prescription

Date of Burn (mo- mo).....10- 11	Aspect (deg.).....
Wind Direction (deg.).....140,220	Spread Direction (B/H/F)..
Fuel (tns/ac).....0.0- 0.0	Herb Moisture (%).....80- 80
Live Woody (tns/ac).....0.0- 0.0	Midflame Wind (mph).....0.0- 0.0
Herbs (tns/ac).....0.0- 0.0	Rate of Spread (ch/hr)..0.0- 0.0
Air Temp. (F).....0- 0	Heat per Area (btu/ft ²)..0.0- 0.0
Rel. Humidity (%).....0- 0	Fireline Intns (btu/ft ²)0.0- 0.0
1- hr TLFM (%).....0- 0	Slope (%).....0- 0
10- hr TLFM (%).....0	Flame Length (ft).....0.0- 0.0
100- hr TLFM (%).....0	Flame Zone Depth (ft)...0.0- 0.0
1000- hr TLFM (%).....0	Scorch Height (m).....0.0- 0.0
Woody Moisture (%).....0- 0	Char Height (m).....0.0- 0.0

Additional Prescription Information: This type is to be burned using Ping Pong ball aerial ignition. The prescription is based on Live Fuel Moistures only (need to average 80%).

Management Objectives: Reduce tree stem density by 20- 50% one- year post burn. Decrease shrub cover by 20- 30% one- year post burn. Increase or maintain cover and diversity of native herbaceous species 5 years post burn and beyond. Leave 15- 20% of the treatment area unburned, allow no more than 15% of the treatment area to be severely burned (consumption of the foliage not to include woody material to be 80% or more of a patch with patches not to exceed 12 acres

in size), allow 65- 85% of the treatment area to be moderately burned.

Monitoring Objectives: Measure the average stem density of overstory trees with a sufficient sample size to be 90% confident that our sample mean will be within 25% of the population mean. Measure shrub cover with a sufficient sample size to be 80% confident that our sample mean will be within 25% of the population mean. Measure cover of herbaceous species to be 80% confident that our ample mean is within 25% of our true population mean. Measure average burn severities to be 80% certain that our sample mean is within 25% of the true mean value.

Objective Variables: Density of tree stems; percent cover of shrub species; percent cover of herbaceous species; average burn severity.

Physical Description: Includes sites with mostly southerly aspects, all slopes with an elevation range of 4000 to 6000 feet, which includes upper, mid to lower slopes. The area is characterized by large rock outcrops and is dissected by many drainages.

Biological Description: *Quercus arizonica* and *Quercus emoryi* dominate at lower elevations with *Pinus discolor* and *Juniperus deppeana* dominating as the elevation increases. Area is characterized as chaparral- like, with occasional *Quercus emoryi* and *Pinus discolor* barely emerging from thickets of *Arctostaphylos*. Shrub layer is frequently very dense, and is typically composed of *Arctostaphylos pungens*, *Garrya wrightii*, *Yucca schottii*, *Mimosa biuncifera*, *Nolina microcarpa*, *Agave palmeri*, *Opuntia*(s) and *Acacia*. The herbaceous understory consists mostly of various grass species and annual forbs.

Rejection Criteria: Rock outcrops >25% of plot; <15m from trail/road/fire- line; Ravine bottoms.

Notes (This Entire Monitoring Type): The objectives for this type were modified in 1999 by Kathy Schon and Elizabeth Anderson.

----- **General Protocols** -----

Comments (Deviations, Problems, Omissions), this Version Only: This monitoring type was developed in 1998. Many changes were made during the development process. The initial 10 plots were all placed in the Chimenea burn using a random locating method. They ended up grouped very close together as this type was only found in the bottom third of the burn unit. Many sites were rejected before 10 were found. There may be an auto- correlation problem due to these first 10 being so close together. With this in mind, more plots should be installed even if the minimum plot calculations show we have enough.

Immediate post burn we monitor Overstory Trees (FMH21), and Forest Plot Burn Severity (FMH22). On the FMH- 22 we modified it so that we are reading the points off of our herbaceous transect due to the fact that we do not have browns

transects. To do this we use transects 1 and 2 on the data form for Q4- Q1 and 3 and 4 for Q3- Q2 (for both substrate and veg). We record data at meters 1,2,3,4,5,6,7,8,9,10 (transect lines 1&3 on the data sheet for both substrate and veg) and 40,41,42,43,44,45,46,47,48,49(transect lines 2&4 on the data sheet for both substrate and veg).

Preburn:

Control Plots.....No Herb. Height.....Yes
Herbaceous Density.....No Abbreviated Tags.....Yes
oP/Origin Buried.....No Herbaceous Fuel Load.....No
Voucher Specimens.....Yes Brush Fuel Load.....No
Count Dead Branches of Living Plants as Dead.....No

Width "Observed" Transect..0.0m
Herb Transects Sampled....Q4- Q1 Q3- Q2
Shrub Transects Sampled....Q4- Q1 Q3- Q2
Length One Shrub Transect..5.0m Width One Shrub Transect...2.0m
Total Shrub Area.....200.0m²
Stakes Installed At.....17

Burn and Duff Moisture.....No Flame Zone Depth.....No

Postburn:

100 Points Burn Severity...No Herbaceous Fuel Load.....No
Herb. (FMH- 15/17/21).....Yes

----- **Forest Plot Protocols** -----

Overstory:

Live Tree Damage.....No Live Crown Position.....No
Dead Tree Damage.....No Dead Crown Position.....No
Record DBH Year 1.....Yes
Total Length Sample Area...100.0m Total Width Sample Area.....10.0m
Total Sample Area.....1000.00m²
Quarters Sampled.....1 2 3 4
Minimum allowed DBH.....15.1cm Maximum allowed DBH.....999.9cm

Pole- size:

Live Height.....Yes Poles Tagged.....No
Dead Height.....Yes Record DBH Year 1.....Yes
Total Length Sample Area...25.0m Total Width Sample Area.....10.0m
Total Sample Area.....250.00m²
Quarters Sampled.....1
Minimum allowed DBH.....2.5cm Maximum allowed DBH.....15.0cm

Seedling:

Live Height.....Yes Seedlings Mapped.....No
Dead Height.....Yes Dead Seedlings.....Yes

Total Length Sample Area...25.0m Total Width Sample Area.....10.0m
Total Sample Area.....250.00m²
Quarters Sampled.....1

Fuel Load:

Number of Sampling Planes..0 1 HR Plane Length.....oft
10 HR Plane Length.....oft 100 HR Plane Length.....oft
1000 HR Sound Plane Length.oft 1000 HR Rotten Plane Length.oft
Calculate Dominance.....Yes

Postburn:

Overstory Char Height.....No
Pole- sized Postburn Assessment....No Pole- sized Char Height.....No
Severity Transects Sampled.....Q4- Q1 Q3- Q2

FMH- 4 Monitoring Type Protocols FMH Data - SAGU
FMH version 3.10, Printed on 11/16/01, 2:24:19 pm

Current directory: D:\FMHFINAL\SAGU
Found on the NT Desktop, Fire Effects
Last update: 11- 18- 01

----- Description -----

Monitoring Type Code: FPIPO1G09 Date Described: 05/31/90

Monitoring Type Name: Ponderosa Pine

Preparer: Schon

FGDC Association:

FMH- 4 Version Title/Description: Version one

Visits Assigned: 00 PRE, 01 Post, 01 YR01, 01 YR02, 01 YR05

Burn Prescription

Date of Burn (mo- mo).....06- 07	Aspect (deg.).....
Wind Direction (deg.).....140,220	Spread Direction (B/H/F)..BHF
Fuel (tns/ac).....0.0- 0.0	Herb Moisture (%).....0- 0
Live Woody (tns/ac).....0.0- 0.0	Midflame Wind (mph).....0.0- 0.0
Herbs (tns/ac).....0.0- 0.0	Rate of Spread (ch/hr)..0.0- 0.0
Air Temp. (F).....60- 80	Heat per Area (btu/ft ²)..0.0- 0.0
Rel. Humidity (%).....18- 40	Fireline Intns (btu/ft ²)0.0- 0.0
1- hr TLFM (%).....0- 0	Slope (%).....0- 0
10- hr TLFM (%).....8	Flame Length (ft).....0.0- 0.0
100- hr TLFM (%).....0	Flame Zone Depth (ft)...0.0- 0.0
1000- hr TLFM (%).....0	Scorch Height (m).....0.0- 0.0
Woody Moisture (%).....0- 0	Char Height (m).....0.0- 0.0

Additional Prescription Information: (No information provided)

Management Objectives: Reduce total fuel loading by 30- 60% 1 year post burn; reduce pole size tree density by 30- 50% 2 year post burn; acceptable mortality for overstory trees is less than or equal to 15% of a reduction in density 2 year post burn (not to drop below 163 trees/acre); increase or maintain native herbaceous cover and diversity 5 year post burn and beyond, leave 15- 25% of the treatment area unburned, allow no more than 15% of the treatment area to be severely burned (severely burned being defined as consumption of the foliage - not to include woody material - to be 80% or more of a patch with patches not to exceed 12 acres in size, allow 65- 85%

of the treatment area to be moderately burned.

Monitoring Objectives: Measure the average total fuel load in the Ponderosa Pine Forests with a sufficient sample size to be 90% confident that the sample mean will be within 25% of the population mean. Measure pole tree density with a sufficient sample size to be 90% confident that our sample mean will be within 25% of the population mean. Measure the average density of overstory trees with a sufficient sample size to be 90% certain that the sample mean will be within 25% of the population mean. Measure the average cover and diversity of understory species with a sufficient sample size to be 80% confident that the sample mean will be within 25% of the population mean. Measure the average severity on vegetation and substrate to be 80% certain that the estimates are within 25% of the true value.

Objective Variables: Total Fuel Load; density of overstory and pole sized trees; total understory cover/frequency; average veg and substrate severity.

Physical Description: Includes upland sites on all aspects and slopes with an elevation from 6000 to 8600 feet, which includes upper, mid to lower slopes. The area is characterized by cliffs, rock outcrops/ridgelines, steep canyons, and numerous small drainages.

Biological Description: Overstory dominated by Ponderosa Pine (*Pinus ponderosa*). Southwestern White Pine (*Pinus strobiformis*) is codominant with understory trees consisting of Gambles oak (*Quercus gambelii*), Silverleaf Oak (*Quercus hypoleucooides*), Arizona Oak (*Quercus arizonica*) and Net leaf oak (*Quercus reticulata*) with occasional Alligator Juniper (*Juniperus depeanna*). Shrubs include: *Symphoricarpos oreophilus* and *Ceanothus fendleri*. Herbaceous species include: *Muhlenbergia virescens*, *Carex goephylla*, *Pteidium aquilinum*, *Senecio wootonii*, *Dugaldia hoopesii*, *Bromus ciliates*, and various other legumes, scrophs and composites.

Rejection Criteria: Exclude riparian areas where the species composition changes (this does not include the many small drainages where the spp stay the same). Large rock outcroppings (>25% of the plot). Areas <20m from trails/roads/fire lines/other FMH plots.

Notes (This Entire Monitoring Type): This monitoring type is ignited by hand with drip torches. When the second entry burn for this type occurs, it is the recommendation of the Fire Effects Manager/Specialist to add dead crown position. Since this type was initiated the FMH program has developed better snag crown positions codes. She also recommends increasing the sample size of seedling trees to more than one quarter and the herbaceous data changed to include Op- 50P. Also, the objectives will need to be revisited and updated.

----- **General Protocols** -----

Comments (Deviations, Problems, Omissions), this Version Only: Belt transect

width started out as 10m wide. This was changed to 5m in 1996. The only data affected was the pre, yr1 and yr2 data from Duckbill (FPIPO1G09 01,02,06,08,10). This was corrected by cutting the number of spp observed by size class in half. Because the shrubs in this type are few and evenly distributed, this was approved by the Prescribed Fire Specialist (Rick Anderson) and Fire Effects Specialist (Kathy Schon) from SAGU with guidance from the Regional Fire Effects Specialist (Elizabeth Anderson).

This type use to be called FPIPO2G09. In 1996 it was changed to FPIPO1G09.

Preburn:

Control Plots.....No Herb. Height.....No
 Herbaceous Density.....No Abbreviated Tags.....Yes
 oP/Origin Buried.....No Herbaceous Fuel Load.....No
 Voucher Specimens.....Yes Brush Fuel Load.....No
 Count Dead Branches of Living Plants as Dead.....No

Width "Observed" Transect..0.0m
 Herb Transects Sampled....Q4- Q1 Q3- Q2
 Shrub Transects Sampled....Q4- Q1 Q3- Q2
 Length One Shrub Transect..5.0m Width One Shrub Transect...5.0m
 Total Shrub Area.....500.0m2
 Stakes Installed At.....17

Burn and Duff Moisture.....No Flame Zone Depth.....Yes

Postburn:

100 Points Burn Severity...No Herbaceous Fuel Load.....No
 Herb. (FMH- 15/17/21).....No

----- Forest Plot Protocols -----

Overstory:

Live Tree Damage.....Yes Live Crown Position.....Yes
 Dead Tree Damage.....Yes Dead Crown Position.....Yes
 Record DBH Year 1.....Yes
 Total Length Sample Area..50.0m Total Width Sample Area.....20.0m
 Total Sample Area.....1000.00m2
 Quarters Sampled.....1 2 3 4
 Minimum allowed DBH.....15.1cm Maximum allowed DBH.....999.9cm

Pole- size:

Live Height.....Yes Poles Tagged.....Yes
 Dead Height.....Yes Record DBH Year 1.....Yes
 Total Length Sample Area..25.0m Total Width Sample Area.....10.0m
 Total Sample Area.....250.00m2
 Quarters Sampled.....1

Minimum allowed DBH.....2.5cm Maximum allowed DBH.....15.0cm

Seedling:

Live Height.....Yes Seedlings Mapped.....Yes
Dead Height.....Yes Dead Seedlings.....Yes
Total Length Sample Area...10.0m Total Width Sample Area.....5.0m
Total Sample Area.....50.00m²
Subsample of Quarter.....1

Fuel Load:

Number of Sampling Planes..4 1 HR Plane Length.....6ft
10 HR Plane Length.....6ft 100 HR Plane Length.....12ft
1000 HR Sound Plane Length.50ft 1000 HR Rotten Plane Length.50ft
Calculate Dominance.....Yes

Postburn:

Overstory Char Height.....Yes
Pole- sized Postburn Assessment...Yes Pole- sized Char Height.....No
Severity Transects Sampled.....Fuel

FMH- 4 Monitoring Type Protocols FMH Data - SAGU
FMH version 3.10, Printed on 11/16/01, 2:24:53 pm

Current directory: N:\GPS\Fire\Ecology\MonitoringTypes
Last update: 11- 20- 02
Version Two (second burn cycle)

----- Description -----

Monitoring Type Code: FPIPOrT09 Date Described: 11/04/98

Monitoring Type Name: Ponderosa Pine

Preparer: Schon

FGDC Association:

FMH- 4 Version Title/Description: Version one

Visits Assigned: 00 PRO1, 00 PRE, 01 Post, 01 YR01, 01 YR02, 01 YR05

Burn Prescription

Date of Burn (mo- mo).....10- 11	Aspect (deg.).....
Wind Direction (deg.).....170- 250	Spread Direction (B/H/F)..BHF
Fuel (tns/ac).....11.5- 26.1	Herb Moisture (%).....na
Live Woody (tns/ac).....na	Midflame Wind (mph).....0.0- 8
Herbs (tns/ac).....na	Rate of Spread (ch/hr)...5- 23
Air Temp. (F).....40- 80	Heat per Area (btu/ft ²)..350- 416
Rel. Humidity (%).....10- 60	Fireline Intns (btu/ft ²)4- 340
1- hr TLFM (%).....4- 10	Slope (%).....na
10- hr TLFM (%).....5- 12	Flame Length (ft).....0.5- 7
100- hr TLFM (%).....6- 15	Flame Zone Depth (ft)...na
1000- hr TLFM (%).....8- 35	Scorch Height (m).....0- 25
live Woody Moisture (%).....>70	Char Height (m).....na
Probability of Ignition(%)....10- 80	

Additional Prescription Information: (No information provided)

Management Objectives: Reduce Total fuel loading to 10.5- 26.5 tons/acre one year post burn; reduce pole size tree density by 15- 30% two year post burn; acceptable mortality for overstory trees is less than or equal to 15% ($\geq 45\text{cm DBH} = \leq 5\%$, $< 45\text{cm DBH} = \leq 15\%$, 15% only acceptable if total of two classes = 15%) of tree density two year post burn ; increase or maintain native herbaceous cover and diversity five year post burn. Leave 15- 25% of the treatment area unburned, allow no more than 15% of the treatment area to be severely burned (severely burned defined as consumption of the foliage - not to include woody material - to be

80% or more of the patches with the patches not to exceed 12 acres in size), allow 65- 85% of the treatment area to be moderately burned.

Monitoring Objectives: Measure the average total fuel load in the Ponderosa Pine Forests with a sufficient sample size to be 90% confident that the sample mean will be within 25% of the population mean. Measure the average density of overstory trees to be 90% certain and pole sized trees with a sufficient sample size to be 90% confident that the sample mean will be within 25% of the population mean. Measure the average frequency for understory species with a sufficient sample size to be 80% confident that the sample mean will be within 25% of the population mean. Measure the average severity of vegetation and substrate to be 80% certain that the sample mean is within 25% of the true value.

Objective Variables: Total Fuel Load; density of O.S. and pole sized trees; total understory cover/frequency; average burn severity.

Physical Description: Includes upland sites on all aspects and slopes with an elevation from 6000 to 8600 feet, which includes upper, mid to lower slopes. The area is characterized by cliffs, rock outcrops/ridgelines, steep canyons, and numerous small drainages.

Biological Description: Overstory dominated by Ponderosa Pine (*Pinus ponderosa*). Co- dominant species include Southwestern White Pine (*Pinus strobiformis*). Understory tree species include: Gambles oak (*Quercus gambelii*), Silverleaf oak (*Quercus hypoleucooides*), Arizona Oak (*Quercus arizonica*) and Netleaf oak (*Quercus reticulata*) with occasional Alligator Juniper (*Juniperus depeanna*). Shrubs include: *Symphoricarpos oreophilus* and *Ceanothus fendleri*. Herbaceous species include: *Muhlenbergia virescence*, *Carex geophylla*, *pteridium aquilinum*, *Senecio wootonii*, *Dugaldia hoopesii*, *Bromus ciliates* and various other legumes, scrophs and composites.

Rejection Criteria: Exclude riparian areas where the species composition changes (this does not include the many small drainages where spp do not change). Large Rock outcroppings (>25% of the plot). Areas <20m from trails/roads/fire lines/other FMH Plots.

Notes (This Entire Monitoring Type): This monitoring type is the exact same as FPIPOrG09 except it is burned in the fall. The same recommendations apply to this type as for the summer burn type (increase veg and seedling sample size, add snag codes). This type also used hand ignition with drip torches.

----- **General Protocols** -----

Comments (Deviations, Problems, Omissions), this Version Only: (No information provided)

Preburn:

Control Plots.....No Herb. Height.....No
Herbaceous Density.....No Abbreviated Tags.....Yes
oP/Origin Buried.....No Herbaceous Fuel Load.....No
Voucher Specimens.....Yes Brush Fuel Load.....No
Count Dead Branches of Living Plants as Dead.....No

Width "Observed" Transect..0.0m
Herb Transects Sampled....Q4- Q1 Q3- Q2
Shrub Transects Sampled....Q4- Q1 Q3- Q2
Length One Shrub Transect..50m Width One Shrub Transect...5.0m
Total Shrub Area.....500.0m2
Stakes Installed At.....17

Burn and Duff Moisture.....No Flame Zone Depth.....Yes

Postburn:

100 Points Burn Severity...No Herbaceous Fuel Load.....No
Herb. (FMH- 15/17/21).....No

----- Forest Plot Protocols -----

Overstory:

Live Tree Damage.....Yes Live Crown Position.....Yes
Dead Tree Damage.....Yes Dead Crown Position.....No
Record DBH Year 1.....Yes
Total Length Sample Area...100.0m Total Width Sample Area.....10.0m
Total Sample Area.....1000.00m2
Quarters Sampled.....1 2 3 4
Minimum allowed DBH.....15.1cm Maximum allowed DBH.....999.9cm

Pole- size:

Live Height.....Yes Poles Tagged.....No
Dead Height.....Yes Record DBH Year 1.....Yes
Total Length Sample Area...25.0m Total Width Sample Area.....10.0m
Total Sample Area.....250.00m2
Quarters Sampled.....1
Minimum allowed DBH.....2.5cm Maximum allowed DBH.....15.0cm

Seedling:

Live Height.....Yes Seedlings Mapped.....Yes
Dead Height.....Yes Dead Seedlings.....Yes
Total Length Sample Area...10.0m Total Width Sample Area.....5.0m
Total Sample Area.....50.00m2
Subsample of Quarter.....1

Fuel Load:

Number of Sampling Planes..4 1 HR Plane Length.....6ft
10 HR Plane Length.....6ft 100 HR Plane Length.....12ft
1000 HR Sound Plane Length.50ft 1000 HR Rotten Plane Length.50ft
Calculate Dominance.....Yes

Postburn:

Overstory Char Height.....Yes
Pole- sized Postburn Assessment...Yes Pole- sized Char Height.....No
Severity Transects Sampled.....Fuel

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----- **Description** -----

Monitoring Type Code: FPSMEIG10 **Date Described:** 11/06/98

Monitoring Type Name: Mixed Conifer Forest

Preparer: Schon

FGDC Association:

FMH- 4 Version Title/Description: Mixed Conifer Forest 2001

Visits Assigned: 00 PR01, 00 PR02, 00 PRE

Burn Prescription

Date of Burn (mo- mo).....06- 07,09- 11 Aspect (deg.).....
Wind Direction (deg.).....140- 220 Spread Direction (B/H/F)..BF

Fuel (tns/ac).....0.0- 0.0	Herb Moisture (%).....100- 120
Live Woody (tns/ac).....0.0- 0.0	Midflame Wind (mph).....0.0- 5.0
Herbs (tns/ac).....0.0- 0.0	Rate of Spread (ch/hr)..0.0- 0.0
Air Temp. (F).....60- 80	Heat per Area (btu/ft²)..0.0- 0.0
Rel. Humidity (%).....15- 35	Fireline Intns (btu/ft²)0.0- 0.0
1- hr TLFM (%).....0- 0	Slope (%).....0- 0
10- hr TLFM (%).....10	Flame Length (ft).....0.0- 0.0
100- hr TLFM (%).....0	Flame Zone Depth (ft)...0.0- 0.0
1000- hr TLFM (%).....0	Scorch Height (m).....0.0- 0.0
Woody Moisture (%).....0- 0	Char Height (m).....0.0- 0.0

Additional Prescription Information: Prescription to be updated before burning in this type.

Management Objectives: Reduce total fuel load by at least 30- 50% one year post burn while maintaining total 1000hr fuels at 5- 7 tons/acre; reduce pole tree density by at least 30- 50% two years post burn; acceptable mortality of overstory species is less than or equal to 10% five year post burn; increase or maintain native herbaceous cover and diversity five year post burn.

Monitoring Objectives: Measure the average fuel load in the mixed conifer forest with a sufficient sample size to be 95% confident that our sample mean will be within 25% of the population mean. Measure pole tree density with a sufficient sample size to be 90% confident that our sample mean will be within 25% of the population mean. Measure overstory tree density with a sufficient sample size to be 95% confident that our sample mean is within 25% of the population mean. Measure the average cover of understory herbaceous species with a sufficient sample size to be 80% confident that our sample mean is within 25% of our population mean.

Objective Variables: Total fuel load; density of pole sized and overstory trees; cover of understory herbaceous layer.

Physical Description: Aspects mostly northerly; Slopes range from 25 to 75% with an average of 40%; elevation ranges from 7000 to 8600 feet; mid and upper slopes; the area is characterized by steep slopes, punctuated by wet drainages and rocky ridgelines.

Biological Description: Canopy varies from 50- 70% closure. The dominant overstory tree is Doug Fire (*Pseudotsuga menziesii*). Co- dominant species include Ponderosa (*Pinus ponderosa*), Southwestern white pine (*Pinus strobiformis*), White Fir (*Abies concolor*) and Gambles Oak (*Quercus gambelii*). Understory is very dense reaching 70% closure with the above mentioned tree seedlings and shrubs such as Snowberry (*Symphoricarpos oreophilus*) and Mountain spray (*Holodiscus dumosus*). Herbaceous understory consists of seasonal annuals and some grasses. This entire area is characterized by high fuel loading of all dead and down size classes.

Rejection Criteria: Doug fir < 40%; Ponderosa Pine > 50%; Riparian corridors where species composition changes; rock outcroppings (>25% of plot); areas < 10m from trails/roads/fire lines.

Notes (This Entire Monitoring Type): none

----- **General Protocols** -----

Comments (Deviations, Problems, Omissions), this Version Only: Belt width was changed from 10m to 2m in 1997.

Preburn:

Control Plots.....No Herb. Height.....No
Herbaceous Density.....No Abbreviated Tags.....Yes
Op/Origin Buried.....No Herbaceous Fuel Load.....No
Voucher Specimens.....Yes Brush Fuel Load.....No
Count Dead Branches of Living Plants as Dead.....No

Width "Observed" Transect..5.0m
Herb Transects Sampled....Q4- Q1 Q3- Q2
Shrub Transects Sampled....Q4- Q1 Q3- Q2
Length One Shrub Transect..50m Width One Shrub Transect...2.0m
Total Shrub Area.....200.0m2
Stakes Installed At.....17

Burn and Duff Moisture.....No Flame Zone Depth.....Yes

Postburn:

100 Points Burn Severity...No Herbaceous Fuel Load.....No
Herb. (FMH- 15/17/21).....No

----- Forest Plot Protocols -----

Overstory:

Live Tree Damage.....Yes Live Crown Position.....Yes
Dead Tree Damage.....Yes Dead Crown Position.....Yes
Record DBH Year 1.....Yes
Total Length Sample Area...50.0m Total Width Sample Area.....20.0m
Total Sample Area.....1000.00m2
Quarters Sampled.....1 2 3 4
Minimum allowed DBH.....15.1cm Maximum allowed DBH.....999.9cm

Pole- size:

Live Height.....Yes Poles Tagged.....Yes
Dead Height.....Yes Record DBH Year 1.....Yes
Total Length Sample Area...25.0m Total Width Sample Area.....10.0m
Total Sample Area.....250.00m2
Quarters Sampled.....1
Minimum allowed DBH.....2.5cm Maximum allowed DBH.....15.0cm

Seedling:

Live Height.....Yes Seedlings Mapped.....Yes
Dead Height.....Yes Dead Seedlings.....Yes
Total Length Sample Area...25.0m Total Width Sample Area.....10.0m
Total Sample Area.....250.00m2
Quarters Sampled.....1

Fuel Load:

Number of Sampling Planes...4 1 HR Plane Length.....6ft
10 HR Plane Length.....6ft 100 HR Plane Length.....12ft
1000 HR Sound Plane Length.50ft 1000 HR Rotten Plane Length.50ft
Calculate Dominance.....Yes

Postburn:

Overstory Char Height.....Yes
Pole- sized Postburn Assessment....Yes Pole- sized Char Height.....No
Severity Transects Sampled.....Fuel

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FMH version 3.10, Printed on 11/16/01, 1:25:49 pm

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----- Description -----

Monitoring Type Code: FPILErTo4 Date Described: 03/16/00

Monitoring Type Name: Pine Oak Forest/Rincon Fire

Preparer: Schon

FGDC Association:

FMH- 4 Version Title/Description: Version one

Visits Assigned: 00 PRE

Burn Prescription

Date of Burn (mo- mo).....	Aspect (deg.).....
Wind Direction (deg.).....	Spread Direction (B/H/F)..
Fuel (tns/ac).....0.0- 0.0	Herb Moisture (%).....0- 0
Live Woody (tns/ac).....0.0- 0.0	Midflame Wind (mph).....0.0- 0.0
Herbs (tns/ac).....0.0- 0.0	Rate of Spread (ch/hr)..0.0- 0.0
Air Temp. (F).....0- 0	Heat per Area (btu/ft ²)..0.0- 0.0
Rel. Humidity (%).....0- 0	Fireline Intns (btu/ft ²)0.0- 0.0
1- hr TLFM (%).....0- 0	Slope (%).....0- 0
10- hr TLFM (%).....0	Flame Length (ft).....0.0- 0.0
100- hr TLFM (%).....0	Flame Zone Depth (ft)...0.0- 0.0
1000- hr TLFM (%).....0	Scorch Height (m).....0.0- 0.0
Woody Moisture (%).....0- 0	Char Height (m).....0.0- 0.0

Additional Prescription Information: (No information provided)

Management Objectives: To reduce total fuel load by 40- 60% one- year post burn.
To reduce brush tree (tree's growing in shrub form) density by 40- 60% two years post- burn.
To keep overstory pine tree mortality to less than 10% one year post burn and beyond.

Monitoring Objectives: To be 90% certain of detecting a 40% decrease in total fuel load with a sufficient sample size to be within 25% of the true population

mean.

To be 80% certain of detecting a 40% decrease in brush tree density with a sufficient sample size to be within 25% of our true population mean.

Measure O.S. tree density with a large enough sample size to be 90% confident that our sample mean is within 25% of our true population mean.

Objective Variables: Total fuel load, brush tree density, O.S. trees

Physical Description: Includes all slopes and aspects with elevations from 5000- 8600ft including upper, middle and lower slopes.

Biological Description: Overstory scarce but consisting of *Pinus ponderosa* and *Pinus leiophylla*. Understory consisting of a dense layer of *Quercus hypoleucoides* followed by mixed shrubs and grasses (mostly *Ceanothus* and *Muhlenbergia*). Areas of high dead and down material.

Rejection Criteria: Overstory live pine tree cover >50%. Understory live resprouting quercus cover <20% of plot. Rock outcrops >25% of the plot. Steep drainages where spp composition changes. No sign of 1994 Rincon wildfire. <25m from road/trail/fireline/other FMH plots.

Notes (This Entire Monitoring Type): This type was moderately to severely burned in the 1994 Rincon fire. The Fuel Model is unclear, the area is loaded with heavy fuels and dense shrubby oaks with grass and litter in patches underneath. This type looks like a combination of Fuel Model 4 and 10 with some 2 and 6 mixed in.

----- **General Protocols** -----

Comments (Deviations, Problems, Omissions), this Version Only: Rebar tags for plot 1 may say the FM is 2.

Pole trees:

- Pole trees are not tagged with brass #ed tags, use wire or nails (see below)
- When a tree forks above .5m, tag(wire) the largest one only
- When a tree forks below .5m, count each fork as an individual.
- Tag with wire at DBH for tree that are dead or very small
- Tag with a nail on all others (this will assure that all trees are counted each year).
- Stay consistent from year to year. Even if a fork that was below .5m grows in 10 years to a fork above .5m, keep it the same.

Seedlings:

- Pine and Juniper seedlings are counted and mapped in all quarters.
- Only count seedlings if they are coming out of the ground or the base of a tree (i.e. do not count forks individually only count the largest one).
- Oak seedlings are counted in the brush belt only.

Brush:

- Do not include *Arctostaphylos* in the brush belt or any spp that is clonal and you are unable to distinguish individuals.

- Do stem count oak seedlings in the brush belt. This includes resprouts from dead or live trees. Stem counting is defined as counting all stems separately as if they were their own plant. They are considered separate if they are coming out of the ground or coming out of the base of a tree. Do not count them as separate if they are coming out of another stem or bole of a tree. Oak seedlings are counted here due to the form being more shrub like and to avoid having to enter two seedling tree data sheets like in the POF type.



6 stems 1 stem

- To avoid confusion it is best to use the intervals when reading brush in this type.
- Use the brush codes for the tree spp. i.e., QUHY2 and QUAR3....check species code list.

Herbs:

- Read along Q4- Q1 and Q3- Q2 and follow standard FMH protocols (Note: all tree species encountered are to be treated like a tree not brush. For Example; if you encounter a QUHY it is to be given the tree code of QUHY1 and treated as a tree - if it is over 2m tall you would not include it here).

Rebar:

- Install 13 pieces (do not include rebar for the start of brown lines).

Preburn:

Control Plots.....No Herb. Height.....Yes
 Herbaceous Density.....No Abbreviated Tags.....Yes
 OP/Origin Buried.....No Herbaceous Fuel Load.....No
 Voucher Specimens.....Yes Brush Fuel Load.....No
 Count Dead Branches of Living Plants as Dead.....No

Width "Observed" Transect..5.0m
 Herb Transects Sampled....Q4- Q1 Q3- Q2
 Shrub Transects Sampled....Q4- Q1 Q3- Q2
 Length One Shrub Transect..50m Width One Shrub Transect...1.0m
 Total Shrub Area.....100.0m² Stakes Installed At.....13
 Burn and Duff Moisture.....No Flame Zone Depth.....Yes

Postburn:

100 Points Burn Severity...No Herbaceous Fuel Load.....No
 Herb. (FMH- 15/17/21).....No

----- Forest Plot Protocols -----

Overstory:

Live Tree Damage.....Yes Live Crown Position.....Yes
Dead Tree Damage.....Yes Dead Crown Position.....Yes
Record DBH Year 1.....Yes
Total Length Sample Area...50.0m Total Width Sample Area.....20.0m
Total Sample Area.....1000.00m²
Quarters Sampled.....1 2 3 4
Minimum allowed DBH.....15.1cm Maximum allowed DBH.....999.9cm

Pole- size:

Live Height.....Yes Poles Tagged.....No
Dead Height.....Yes Record DBH Year 1.....Yes
Total Length Sample Area...25.0m Total Width Sample Area.....10.0m
Total Sample Area.....250.00m²
Quarters Sampled.....1
Minimum allowed DBH.....2.5cm Maximum allowed DBH.....15.0cm

Seedling:

Live Height.....Yes Seedlings Mapped.....Yes
Dead Height.....Yes Dead Seedlings.....Yes
Total Length Sample Area...50.0m Total Width Sample Area.....20.0m
Total Sample Area.....1000.00m²
Quarters Sampled.....1 2 3 4

Fuel Load:

Number of Sampling Planes..4 1 HR Plane Length.....6ft
10 HR Plane Length.....6ft 100 HR Plane Length.....12ft
1000 HR Sound Plane Length.50ft 1000 HR Rotten Plane Length.50ft
Calculate Dominance.....Yes

Post- burn:

Overstory Char Height.....Yes
Pole- sized Postburn AssessmYes Pole- sized Char Height.....No
Severity Transects Sampled.Fuel

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----- Description -----

Monitoring Type Code: FQUARIT09 Date Described: 08/17/99

Monitoring Type Name: PINE OAK FOREST

Preparer: K. SCHON

FGDC Association:

FMH- 4 Version Title/Description: Version one

Visits Assigned: 00 PRE

Burn Prescription:

Date of Burn (mo- mo).....09- 11	Aspect (deg.).....
Wind Direction (deg.).....140,220	Spread Direction (B/H/F)..
Fuel (tns/ac).....0.0- 0.0	Herb Moisture (%).....0- 0
Live Woody (tns/ac).....0.0- 0.0	Midflame Wind (mph).....0.0- 0.0
Herbs (tns/ac).....0.0- 0.0	Rate of Spread (ch/hr)..0.0- 0.0
Air Temp. (F).....60- 80	Heat per Area (btu/ft ²)..0.0- 0.0
Rel. Humidity (%).....18- 40	Fireline Intns (btu/ft ²)0.0- 0.0
1- hr TLFM (%).....0- 0	Slope (%).....0- 0
10- hr TLFM (%).....10	Flame Length (ft).....0.0- 0.0
100- hr TLFM (%).....0	Flame Zone Depth (ft)...0.0- 0.0
1000- hr TLFM (%).....0	Scorch Height (m).....0.0- 0.0
Woody Moisture (%).....0- 0	Char Height (m).....0.0- 0.0

Additional Prescription Information: none

Management Objectives: To reduce total fuel load by no more than 50% immediately post burn and maintain a total fuel load between 15- 30 tons/acre 5 years post burn and beyond. To reduce the number of pole class oak stems from 876.7 (changed from previously calculated 876.7 stems/hectare to 520- 800 stems per hectare (10- 40% reduction) one year post burn. To limit overstory tree mortality to less than or equal to 15% from their pre- burn values. To

maintain or increase native herb and shrub species percent cover and diversity 5 years post burn excluding *Arctostaphylos pungens* which will be maintained at its current level 5 years post burn. To leave 15- 20% of the treatment area unburned, allow no more than 15% of treatment area to be severely burned (severely burned being consumption of the foliage - not including woody material- to be 80% or more of a patch with patches not to exceed 12 acres in size), allow 65- 85% of the treatment area to be moderately burned.

Monitoring Objectives: Measure the total fuel load with a large enough sample size to be 90% confident that the sample mean for is within 25% of the true population mean. Measure pole tree density with a large enough sample size to be 90% confident that our sample mean is within 25% of our true population mean. Measure overstory tree density with a large enough sample size to be 90% confident that our sample mean is within 25% of our true population mean. Measure herbaceous density and diversity with a sufficient sample size to be 80% confident that our sample mean is within 25% of the true population mean. Measure burn severity of vegetation and substrate to be 80% certain that our sample mean is within 25% of the true mean value.

Objective Variables: Overstory tree density, Herbaceous density and diversity, Total fuel load, pole tree density, burn severity

Physical Description: This association, which occurs from 5300 to 8000ft, is one of the most variable associations at higher elevations in the Rincons as far as the physical description is concerned.

Biological Description: This type can be distinguished from either pine- oak woodland or pine forests by the larger number of *Quercus* species and by the presence of *Pinus leiophylla*. Moreover, pine- oak forest is intermediate in stature between pine forest, in which trees are typically greater than 80 feet tall, and pine- oak woodland, in which trees are mostly less than 20 ft tall. This type includes a variety of pines and oaks: *Pinus ponderosa*, *Pinus strobiformis*, *Pinus leiophylla*, *Pinus discolor*, *Quercus rugosa*, *Quercus arizonica* and *Quercus hypoleucoides*. The shrub layer varies with elevation. Lower elevations include *Arctostaphylos pungens* and *pringlei*, *Rhamnus betulifolia*, *Acacia angustissima*, *Nolina microcarpa*, *Mimosa biuncifera* and *Garrya wrightii*. Upper elevations include *Symphoricarpos oreophilus*, *Berberis wilcoxii*, *Rubus neomexicanus*, *Ceanothus fendleri* and *Rhamnus californicus*. The herb layer is poorly developed where the canopy is dense and richer where trees and shrubs are scattered. The understory is frequently dominated by grasses, particularly *Muhlenbergia virescens*, *Poa fendleriana*, *Koeleria cristata*, *Panicum bulbosum*, *Blepharoneuron tricholepis*, *Elymus arizonicus*, *Stipa pringlei* and *Piptochaetium fimbriatum*.

Rejection Criteria: Less than 50m from another fire effects plot and/or a trail. Rock outcrops larger than 25% of total plot area. Average tree height under 20 ft. Less than 50% overstory tree cover. Overstory consists of > 70% Ponderosa Pine and/or less than 20% Oak species. Plots located in the Rincon fire of 1994

that were severely burned leaving mostly new regenerated oak species and little tall overstory pine/oak species.

Notes (This Entire Monitoring Type): Objectives were established by:

Kathy Schon Fire Effects

Rick Anderson Prescribed fire

Pam Anning Resource management

Meg Weesner Resource management

Natasha Kline Resource management

Mark Holden Resource management

----- **General Protocols** -----

Comments (Deviations, Problems, Omissions), this Version Only: This type was developed in 1999. In dealing with resprouting trees we consulted various professionals and opted for the protocols listed below:

1. For Overstory and Pole:
For Sprouting species (Quercus and Juniperus):
Count individual stems that fork at or below .5m as individuals and tag each one. If the tree is forked above .5m, take DBH of largest fork only and tag this fork. Count individual tagged trees and poles as dead based on that stem/tree individual regardless of whether the root system is alive (i.e. just because the tree is resprouting, do not count a dead stem as live). For non sprouting trees (PIPO, PIST, PILE count with normal FMH protocols (i.e. If it forks below DBH, count them as separate trees and tag each one).
2. If a fork is of seedling size and is coming off the bole(not the base) of a tree, it is not included as a seedling.
3. If a fork does not rise to DBH height, it is not included as a tree or pole(this will exclude horizontal branching that could be otherwise mistaken for a fork).
4. Seedlings that resprout from the base of a parent tree are counted.
If a seedling forks off the bole, do not count the fork. as a separate seedling. If the seedling is coming from the base, then count it separately.
5. Do not map seedlings that are in height class one through 5. Do not map dead seedlings (chances are these will be gone after the burn). Resprouts are mapped as R1, R2, etc., and other seedlings as A, B, CC,etc. Only tally seedlings in size classes 1- 5 as all others will have their own map location identification #.
6. Quercus and Juniper seedlings are counted in a 5 x 10 m

area only (the interval closest to the origin, i.e. 10m wide and 5m long starting at the Origin). All other species are counted in all of Q₁. Use a separate data sheet for these species as they will have to be entered in a different way (you should have two seedling data sheets for each plot, one should be for all of Q₁ and not have any Quercus or Juniperus spp and the other should be for the 5x10m area with Quercus and Juniper). The 5x10m area form should have the monitoring type FQUAR₂T₀₉ instead of QUAR₁. They must have different monitoring types because you can not enter two different seedling data forms for one plot).

Shrubs:

- i. Do not include Arctostaphylos species, or other clonal spp in shrub belt, as you cannot distinguish individuals.

Preburn:

Control Plots.....No Herb. Height.....Yes
 Herbaceous Density.....No Abbreviated Tags.....Yes
 OP/Origin Buried.....No Herbaceous Fuel Load.....No
 Voucher Specimens.....Yes Brush Fuel Load.....No
 Count Dead Branches of Living Plants as Dead.....No

Width "Observed" Transect..5.0m
 Herb Transects Sampled....Q₄- Q₁ Q₃- Q₂
 Shrub Transects Sampled....Q₄- Q₁ Q₃- Q₂
 Length One Shrub Transect..50m Width One Shrub Transect...5.0m
 Total Shrub Area.....500.0m²
 Stakes Installed At.....17

Burn and Duff Moisture.....No Flame Zone Depth.....Yes
 Postburn 100 Points Burn Severity...No Herbaceous Fuel Load.....No
 Herb. (FMH- 15/17/21).....No

----- Forest Plot Protocols-----

Overstory:

Live Tree Damage.....Yes Live Crown Position.....Yes
 Dead Tree Damage.....Yes Dead Crown Position.....Yes
 Record DBH Year 1.....Yes
 Total Length Sample Area...50.0m Total Width Sample Area.....20.0m
 Total Sample Area.....1000.00m²
 Quarters Sampled.....1 2 3 4
 Minimum allowed DBH.....15.1cm Maximum allowed DBH.....999.9cm

Pole- size:

Live Height.....Yes Poles Tagged.....Yes
Dead Height.....Yes Record DBH Year 1.....Yes
Total Length Sample Area...25.0m Total Width Sample Area.....10.0m
Total Sample Area.....250.00m²
Quarters Sampled.....1
Minimum allowed DBH.....2.5cm Maximum allowed DBH.....15.0cm

Seedling:

Live Height.....Yes Seedlings Mapped.....Yes
Dead Height.....Yes Dead Seedlings.....Yes
Total Length Sample Area...25.0m Total Width Sample Area.....10.0m
Total Sample Area.....250.00m²
Quarters Sampled.....1

Fuel Load:

Number of Sampling Planes..4 1 HR Plane Length.....6ft
10 HR Plane Length.....6ft 100 HR Plane Length.....12ft
1000 HR Sound Plane Length.50ft 1000 HR Rotten Plane Length.50ft
Calculate Dominance.....Yes

Postburn:

Overstory Char Height.....Yes
Pole- sized Postburn Assessment.....Yes Pole- sized Char Height.....No
Severity Transects Sampled....Fuel

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----- Description -----

Monitoring Type Code: FQUARIT09 Date Described: 08/17/99

Monitoring Type Name: PINE OAK FOREST

Preparer: K. SCHON

FGDC Association:

FMH- 4 Version Title/Description: Version one

Visits Assigned: 00 PRE

Burn Prescription:

Date of Burn (mo- mo).....09- 11	Aspect (deg.).....
Wind Direction (deg.).....140,220	Spread Direction (B/H/F)..
Fuel (tns/ac).....0.0- 0.0	Herb Moisture (%).....0- 0
Live Woody (tns/ac).....0.0- 0.0	Midflame Wind (mph).....0.0- 0.0
Herbs (tns/ac).....0.0- 0.0	Rate of Spread (ch/hr)..0.0- 0.0
Air Temp. (F).....60- 80	Heat per Area (btu/ft ²)..0.0- 0.0
Rel. Humidity (%).....18- 40	Fireline Intns (btu/ft ²)0.0- 0.0
1- hr TLFM (%).....0- 0	Slope (%).....0- 0
10- hr TLFM (%).....10	Flame Length (ft).....0.0- 0.0
100- hr TLFM (%).....0	Flame Zone Depth (ft)...0.0- 0.0
1000- hr TLFM (%).....0	Scorch Height (m).....0.0- 0.0
Woody Moisture (%).....0- 0	Char Height (m).....0.0- 0.0

Additional Prescription Information: none

Management Objectives: To reduce total fuel load by no more than 50% immediately post burn and maintain a total fuel load between 15- 30 tons/acre 5 years post burn and beyond. To reduce the number of pole class oak stems from 876.7 (changed from previously calculated 876.7 stems/hectare to 520- 800 stems per hectare (10- 40% reduction) one year post burn. To limit overstory tree mortality to less than or equal to 15% from their pre- burn values. To

maintain or increase native herb and shrub species percent cover and diversity 5 years post burn excluding *Arctostaphylos pungens* which will be maintained at its current level 5 years post burn. To leave 15- 20% of the treatment area unburned, allow no more than 15% of treatment area to be severely burned (severely burned being consumption of the foliage - not including woody material- to be 80% or more of a patch with patches not to exceed 12 acres in size), allow 65- 85% of the treatment area to be moderately burned.

Monitoring Objectives: Measure the total fuel load with a large enough sample size to be 90% confident that the sample mean for is within 25% of the true population mean. Measure pole tree density with a large enough sample size to be 90% confident that our sample mean is within 25% of our true population mean. Measure overstory tree density with a large enough sample size to be 90% confident that our sample mean is within 25% of our true population mean. Measure herbaceous density and diversity with a sufficient sample size to be 80% confident that our sample mean is within 25% of the true population mean. Measure burn severity of vegetation and substrate to be 80% certain that our sample mean is within 25% of the true mean value.

Objective Variables: Overstory tree density, Herbaceous density and diversity, Total fuel load, pole tree density, burn severity

Physical Description: This association, which occurs from 5300 to 8000ft, is one of the most variable associations at higher elevations in the Rincons as far as the physical description is concerned.

Biological Description: This type can be distinguished from either pine- oak woodland or pine forests by the larger number of *Quercus* species and by the presence of *Pinus leiophylla*. Moreover, pine- oak forest is intermediate in stature between pine forest, in which trees are typically greater than 80 feet tall, and pine- oak woodland, in which trees are mostly less than 20 ft tall. This type includes a variety of pines and oaks: *Pinus ponderosa*, *Pinus strobiformis*, *Pinus leiophylla*, *Pinus discolor*, *Quercus rugosa*, *Quercus arizonica* and *Quercus hypoleucoides*. The shrub layer varies with elevation. Lower elevations include *Arctostaphylos pungens* and *pringlei*, *Rhamnus betulifolia*, *Acacia angustissima*, *Nolina microcarpa*, *Mimosa biuncifera* and *Garrya wrightii*. Upper elevations include *Symphoricarpos oreophilus*, *Berberis wilcoxii*, *Rubus neomexicanus*, *Ceanothus fendleri* and *Rhamnus californicus*. The herb layer is poorly developed where the canopy is dense and richer where trees and shrubs are scattered. The understory is frequently dominated by grasses, particularly *Muhlenbergia virescens*, *Poa fendleriana*, *Koeleria cristata*, *Panicum bulbosum*, *Blepharoneuron tricholepis*, *Elymus arizonicus*, *Stipa pringlei* and *Piptochaetium fimbriatum*.

Rejection Criteria: Less than 50m from another fire effects plot and/or a trail. Rock outcrops larger than 25% of total plot area. Average tree height under 20 ft. Less than 50% overstory tree cover. Overstory consists of > 70% Ponderosa Pine and/or less than 20% Oak species. Plots located in the Rincon fire of 1994

that were severely burned leaving mostly new regenerated oak species and little tall overstory pine/oak species.

Notes (This Entire Monitoring Type): Objectives were established by:

Kathy Schon Fire Effects

Rick Anderson Prescribed fire

Pam Anning Resource management

Meg Weesner Resource management

Natasha Kline Resource management

Mark Holden Resource management

----- **General Protocols** -----

Comments (Deviations, Problems, Omissions), this Version Only: This type was developed in 1999. In dealing with resprouting trees we consulted various professionals and opted for the protocols listed below:

1. For Overstory and Pole:
For Sprouting species (Quercus and Juniperus):
Count individual stems that fork at or below .5m as individuals and tag each one. If the tree is forked above .5m, take DBH of largest fork only and tag this fork. Count individual tagged trees and poles as dead based on that stem/tree individual regardless of whether the root system is alive (i.e. just because the tree is resprouting, do not count a dead stem as live). For non sprouting trees (PIPO, PIST, PILE count with normal FMH protocols (i.e. If it forks below DBH, count them as separate trees and tag each one).
2. If a fork is of seedling size and is coming off the bole(not the base) of a tree, it is not included as a seedling.
3. If a fork does not rise to DBH height, it is not included as a tree or pole(this will exclude horizontal branching that could be otherwise mistaken for a fork).
4. Seedlings that resprout from the base of a parent tree are counted.
If a seedling forks off the bole, do not count the fork. as a separate seedling. If the seedling is coming from the base, then count it separately.
5. Do not map seedlings that are in height class one through 5. Do not map dead seedlings (chances are these will be gone after the burn). Resprouts are mapped as R1, R2, etc., and other seedlings as A, B, CC,etc. Only tally seedlings in size classes 1- 5 as all others will have their own map location identification #.
6. Quercus and Juniper seedlings are counted in a 5 x 10 m

area only (the interval closest to the origin, i.e. 10m wide and 5m long starting at the Origin). All other species are counted in all of Q₁. Use a separate data sheet for these species as they will have to be entered in a different way (you should have two seedling data sheets for each plot, one should be for all of Q₁ and not have any Quercus or Juniperus spp and the other should be for the 5x10m area with Quercus and Juniper). The 5x10m area form should have the monitoring type FQUAR₂T₀₉ instead of QUAR₁. They must have different monitoring types because you can not enter two different seedling data forms for one plot).

Shrubs:

- i. Do not include Arctostaphylos species, or other clonal spp in shrub belt, as you cannot distinguish individuals.

Preburn:

Control Plots.....No Herb. Height.....Yes
 Herbaceous Density.....No Abbreviated Tags.....Yes
 OP/Origin Buried.....No Herbaceous Fuel Load.....No
 Voucher Specimens.....Yes Brush Fuel Load.....No
 Count Dead Branches of Living Plants as Dead.....No

Width "Observed" Transect..5.0m
 Herb Transects Sampled....Q₄- Q₁ Q₃- Q₂
 Shrub Transects Sampled....Q₄- Q₁ Q₃- Q₂
 Length One Shrub Transect..50m Width One Shrub Transect...5.0m
 Total Shrub Area.....500.0m²
 Stakes Installed At.....17

Burn and Duff Moisture.....No Flame Zone Depth.....Yes
 Postburn 100 Points Burn Severity...No Herbaceous Fuel Load.....No
 Herb. (FMH- 15/17/21).....No

----- Forest Plot Protocols-----

Overstory:

Live Tree Damage.....Yes Live Crown Position.....Yes
 Dead Tree Damage.....Yes Dead Crown Position.....Yes
 Record DBH Year 1.....Yes
 Total Length Sample Area...50.0m Total Width Sample Area.....20.0m
 Total Sample Area.....1000.00m²
 Quarters Sampled.....1 2 3 4
 Minimum allowed DBH.....15.1cm Maximum allowed DBH.....999.9cm

Pole- size:

Live Height.....Yes Poles Tagged.....Yes
Dead Height.....Yes Record DBH Year 1.....Yes
Total Length Sample Area...25.0m Total Width Sample Area.....10.0m
Total Sample Area.....250.00m²
Quarters Sampled.....1
Minimum allowed DBH.....2.5cm Maximum allowed DBH.....15.0cm

Seedling:

Live Height.....Yes Seedlings Mapped.....Yes
Dead Height.....Yes Dead Seedlings.....Yes
Total Length Sample Area...25.0m Total Width Sample Area.....10.0m
Total Sample Area.....250.00m²
Quarters Sampled.....1

Fuel Load:

Number of Sampling Planes..4 1 HR Plane Length.....6ft
10 HR Plane Length.....6ft 100 HR Plane Length.....12ft
1000 HR Sound Plane Length.50ft 1000 HR Rotten Plane Length.50ft
Calculate Dominance.....Yes

Postburn:

Overstory Char Height.....Yes
Pole- sized Postburn Assessment.....Yes Pole- sized Char Height.....No
Severity Transects Sampled....Fuel

FMH- 4 Monitoring Type Protocols FMH Data - SAGU
FMH version 3.10, Printed on 11/16/01, 2:28:01 pm

Current directory: D:\FMHFINAL\SAGU
Found on the NT Desktop, Fire Effects
Last update: 11-18-01

----- Description -----

Monitoring Type Code: FQUHYrT09 Date Described: 10/29/01

Monitoring Type Name: Oak Stringers

Preparer: Anderson

FGDC Association:

FMH- 4 Version Title/Description: Version one

Visits Assigned: 00 PRE, 01 Post, 01 yr01, 01 yr02, 01 yr05

Burn Prescription

Date of Burn (mo- mo).....10- 11	Aspect (deg.).....
Wind Direction (deg.).....140,220	Spread Direction (B/H/F)..
Fuel (tns/ac).....0.0- 0.0	Herb Moisture (%).....0- 0
Live Woody (tns/ac).....0.0- 0.0	Midflame Wind (mph)....0.0- 0.0
Herbs (tns/ac).....0.0- 0.0	Rate of Spread (ch/hr)..0.0- 0.0
Air Temp. (F).....60- 80	Heat per Area (btu/ft ²)..0.0- 0.0
Rel. Humidity (%).....18- 40	Fireline Intns (btu/ft ²)0.0- 0.0
1- hr TLFM (%).....0- 0	Slope (%).....0- 0
10- hr TLFM (%).....8	Flame Length (ft).....0.0- 0.0
100- hr TLFM (%).....0	Flame Zone Depth (ft)...0.0- 0.0
1000- hr TLFM (%).....0	Scorch Height (m).....0.0- 0.0
Woody Moisture (%).....0- 0	Char Height (m).....0.0- 0.0

Additional Prescription Information: This type is mixed into the ponderosa pine types and is ignited in the same way using drip torches.

Management Objectives: This type is found within the Ponderosa pine as stringers. We did not have quantifiable objectives for this type. Because it is unique to the Ponderosa pine forest we decided to install plots and follow trends. Therefore, our only objective is to monitor these plots to be able to follow trends that may be associated with fire.

Monitoring Objectives: Measure the average total fuel load. Measure the average density of overstory trees and pole sized trees. Measure the average frequency and cover for understory species. Measure the average severity of vegetation and substrate.

Objective Variables: Total Fuel Load; density of O.S. and pole sized trees; total understory cover/frequency; average burn severity.

Physical Description: Includes all slopes and aspects with elevations from 5000- 8600ft including upper, middle and lower slopes.

Biological Description: Overstory cover dominated by *Quercus hypoleucoides* with *Pinus ponderosa* and *Pinus strobiformis* mixed in and mostly reach above the QUHY canopy. Other oak and juniper spp are mixed in at a much lower lever. Shrubs include *Arctostaphylos pungens*, *Ceanothus*, *Artemesia* and other less dominant spp. Herbaceous layer include a mixture of grasses and forbs dominated by *Muhlenbergis virescens*.

Rejection Criteria: Less than 70% cover of *Quercus hypoleucoides* (any type where QUHY is not the major tree species in the mid level canopy), drainages where vegetation composition changes, rock outcrops >25% of plot.

Notes (This Entire Monitoring Type): This type is not a classified vegetation type. It is found as an anomaly within other types most likely caused from stand replacement fire.

----- **General Protocols** -----

Comments (Deviations, Problems, Omissions), this Version Only: This monitoring type can be found scattered in the Ponderosa Pine forests. It can be found as "stringers" within the PIPO type. We initially wanted to look at these "stringers" as a separate monitoring type. It was difficult to find enough plots to meet minimum plot calc's. After Discussing the situation with Elizabeth Anderson the Regional Fire Effects Specialist it was decided to leave these plots as a separate type even though we will not be able to put in 10 or more plots. Thus the statistical validity of this type may be such that we will not be able to determine if we met the objectives. We will continue to monitor these plots and may put in more if more are found.

Arctostaphylos species are not included in the brush belt as they are clonal spp and individuals cannot be distinguished.

The objectives for this type are few due to the uncertainty of the ecology of these "stringers".

Preburn:

Control Plots.....No Herb. Height.....No
Herbaceous Density.....No Abbreviated Tags.....Yes
oP/Origin Buried.....No Herbaceous Fuel Load.....No
Voucher Specimens.....Yes Brush Fuel Load.....No
Count Dead Branches of Living Plants as Dead.....No

Width "Observed" Transect..5.0m
Herb Transects Sampled....Q4- Q1 Q3- Q2
Shrub Transects Sampled....Q4- Q1 Q3- Q2
Length One Shrub Transect..50m Width One Shrub Transect...5.0m
Total Shrub Area.....500.0m2
Stakes Installed At.....17

Burn and Duff Moisture.....No Flame Zone Depth.....Yes

Postburn:

100 Points Burn Severity...No Herbaceous Fuel Load.....No
Herb. (FMH- 15/17/21).....No

----- Forest Plot Protocols -----

Overstory:

Live Tree Damage.....Yes Live Crown Position.....Yes
Dead Tree Damage.....Yes Dead Crown Position.....Yes
Record DBH Year 1.....Yes
Total Length Sample Area..50.0m Total Width Sample Area.....20.0m
Total Sample Area.....1000.00m2
Quarters Sampled.....1 2 3 4
Minimum allowed DBH.....15.1cm Maximum allowed DBH.....999.9cm

Pole- size:

Live Height.....Yes Poles Tagged.....Yes
Dead Height.....Yes Record DBH Year 1.....Yes
Total Length Sample Area...25.0m Total Width Sample Area.....10.0m
Total Sample Area.....250.00m2
Quarters Sampled.....1
Minimum allowed DBH.....2.5cm Maximum allowed DBH.....15.0cm

Seedling:

Live Height.....Yes Seedlings Mapped.....Yes
Dead Height.....Yes Dead Seedlings.....Yes
Total Length Sample Area...10.0m Total Width Sample Area.....5.0m

Total Sample Area.....50.00m2
Subsample of Quarter.....1

Fuel Load:

Number of Sampling Planes..4 1 HR Plane Length.....6ft
10 HR Plane Length.....6ft 100 HR Plane Length.....12ft
1000 HR Sound Plane Length.50ft 1000 HR Rotten Plane Length.50ft
Calculate Dominance.....Yes

Postburn:

Overstory Char Height.....Yes
Pole- sized Postburn Assessment....Yes Pole- sized Char Height.....No
Severity Transects Sampled.....Fuel

SAGUARO NATIONAL PARK
 FIRE MANAGEMENT OFFICE
 5- YEAR BURN PLAN

This document describes the park’s prescribed fire operations program for the next 5 years. Delays in project approvals, wildland fire impacts or other factors could require modification of this schedule.

Other projects that will be occurring to coincide with successful completion of our prescribed burn efforts will be:

- Installing Fire Effects Plots in first entry burn units as needed in order to assess fuel loading reduction objectives and other related fire effects objectives.
- Re- reading Fire Effects Plots in 2nd entry burn units to assess whether burn objectives are being met.
- Tracking fuel moisture conditions for prescribed fire operations and preparedness planning.

Burn Unit Priority Analysis:

Burn unit execution priorities may shift throughout the life of this plan. The park’s program is ambitious and there are limits to the number of units and amount of acres that can be burned. The largest impact and limiting factor affecting prescribed fire operations is annual fire workload, (wildland fire and prescribed fire). Other limiting factors are seasonal weather, drought, preparedness levels, and funding.

The Fire Management Office will continually analyze the park’s manageable fire load based on the following factors:

- Are there constraints dictated by regional and national preparedness levels?
- Will the fire meet hazard fuel reduction and/or natural resources management goals?
- Will the fire cause excessive fire personnel workload and fatigue, which could result in poor decisions with accompanying increases in risks to personnel?
- What is the likelihood of the prescribed fire escaping control?
- Will there be adequate availability of contingency resources?
- Will there be project (burn unit) funding available?

Overall park burning priorities are established in this document as a guide to facilitate the most efficient use of resources, and burn unit execution scheduling, in order to accomplish hazard fuels reduction and ecosystem restoration and maintenance in the areas at highest risk. The outside observer should keep in mind that dozens of variables must be considered continuously throughout the course of the fire season in order to realistically forecast burn units that can be successfully completed.

Prescribed Burn Unit Priority Order:

#	UNIT NAME	SIZE (acres)	SEASON	NOTES
1	Devil’s Bathtub	550	Summer, fall ok	2 nd Entry
2	East Slope	400	Fall	1 st Entry
3	Saddle	2000	Summer, fall ok	1 st Entry

4	Chimenea	2000	Summer, fall ok	2 nd Entry
5	North Slope	3000	Fall	2 nd Entry

Burn Unit Descriptions:

1. Devil’s Bathtub Burn Unit

Project Number 0001

Purpose: This unit was last burned in the fall of 1997. It is comprised primarily of ponderosa pine forest with pine- oak forests located at the lower elevations. The fire regime for this area is dominated by a regular pattern of widespread ground fires with a mean fire interval of every 6 years. Historic fire occurrence appears to have been confined to the late spring and early summer. The primary purpose of this project is to restore the natural fire regime to reduce hazardous fuel buildup caused by over a century of fire suppression. This action will provide for quality Mexican Spotted Owl (MSO) habitat by reducing the chance for catastrophic fire. It will provide for openings, which will increase the native herbaceous cover required for food and habitat for a number of other species including prey species for the MSO. These natural “gaps” will provide natural fuel breaks for an otherwise continuous canopy layer. It will reduce ladder fuels, which will keep wildland fires out of the forest canopy. By introducing fire in such an ecologically appropriate manner, this area will once again be able to safely accept managed wildland fire.

Predominant Vegetation Types: Ponderosa Pine

Location: Rincon Mountain District. Southwest facing slope of Mica Mountain, southeast of Manning Cabin. North of Devil’s Bathtub Spring.

Latitude: 32° 12’, Longitude: 110° 32’

Township 14S, Range 18E, sec. 19

Elevation Range: 7,600’ to 8,200’

Aspect: South and West

Condition Class:2

Activities: Understory Burn

Compliance Issues: Mexican spotted owl

Smoke Sensitive Areas: Tucson Basin, Manning Camp, Rincon Valley, Park HQ

Planned Acres: 550

Planned Dates: start → June; end → October

Smoke Emissions: Veg. Type – Ponderosa Pine

Estimated tons per Acre –

Planned tons per acre consumption –

2. East Slope Burn Unit

Project Number 0002

Purpose: Historically this area has seen more fire than most areas in the park according to the Park’s fire atlas. At this time, this area has not had fire in it since 1994. Parts of this unit are habitat for MSO’s as well as Peregrine falcons. Located within the unit is a well established aspen stand which has been maintained historically by fire. Restoring fire into this area after 11 years of fire exclusion will closely mimic the occurrence seen in the fire atlas. This will reduce fuel buildup, decrease erosion and sedimentation impacts, and maintain the aspen stand. By reducing the fuel load and some of the smaller diameter trees, the chance for a catastrophic fire will decrease eventually allowing for managers to use managed wildland fire here.

Predominant Vegetation Types: Mixed conifer, Douglas fir, Aspen and Ponderosa Pine
Location: Rincon Mountain District. East slope of Mica Mountain, from Fire Loop Trail at Mica 2ndary to Reef Rock down the east slope.

Latitude: 32° 12', *Longitude:* 110° 31'

Township 14S, *Range* 18E, sec. 17, 18

Elevation Range: 7,600' to 8,400'

Aspect: East

Condition Class: 3

Activities: Understory Burn

Compliance Issues: Mexican spotted owl

Smoke Sensitive Areas: Tucson Basin, Manning Camp, Rincon Valley, Park HQ

Planned Acres: 400

Planned Dates: start→ September; end→ October

Smoke Emissions: Veg. Type – Mixed conifer, Douglas fir, aspen

Estimated tons per Acre –

Planned tons per acre consumption -

3. Saddle Burn Unit - 2006

Project Number 0003

Purpose: 1st Entry Burn. Restore ponderosa pine and pine/oak forest condition to within the natural range of variability and reduce the risk of catastrophic stand replacing fire occurring over a large area. Restore fire for ecosystem management reasons. Place area into a re-burn schedule that approximates the natural fire cycle in order to maintain reduced fuels and a more natural ecosystem structure. Portions of this unit may be managed with natural fire after hazard fuels are reduced with prescribed fire.

Predominant Vegetation Types: Ponderosa Pine, oak woodland

Location: Rincon Mountain District. Southwest slope of Mica Mountain, from area south of Devil's Bathtub Spring, west of trail to Happy Valley Lookout.

Latitude: 32° 11', *Longitude:* 110° 32'

Township 14S, *Range* 17E and *Range* 18E, sec. 25,26,35,36/30,31,32

Elevation Range: 6,000' to 7,600'

Aspect: South and West

Condition Class:2

Activities: Understory Burn

Compliance Issues: leopard frogs, drainages

Smoke Sensitive Areas: Tucson Basin, Manning Camp, Rincon Valley, Park HQ

Planned Acres: 2000

Planned Dates: start→ June; end→ October

Smoke Emissions: Veg. Type – Ponderosa Pine, pine/oak woodland

Estimated tons per Acre –

Planned tons per acre consumption -

4. Chimenea Burn Unit

Project Number 0004

Purpose: 2nd Entry Burn. Maintain healthy ponderosa pine and pine- oak forest. Provide quality Mexican Spotted Owl habitat. Restore fire for ecosystem management reasons. Place area into a re-burn schedule that approximates the natural fire cycle in order to maintain

reduced fuels and a more natural ecosystem structure. Portions of this unit may be managed with natural fire after hazard fuels are reduced with prescribed fire.

Predominant Vegetation Types: Ponderosa Pine

Location: Rincon Mountain District. Area west of Manning Cabin and encompassed by Cow Head Saddle Trail on the north side, and Manning Camp Trail on the south side. Grass Shack will serve as the western most boundary.

Latitude: 32° 12', *Longitude:* 110° 34'

Township 14S, *Range* 17E, sec. 13,14,22,23,24,27

Elevation Range: 5,600' to 8,000'

Aspect: South and West

Condition Class: 2

Activities: Understory Burn

Compliance Issues: Mexican spotted owl, leopard frogs, and drainages

Smoke Sensitive Areas: Tucson Basin, Manning Camp, Rincon Valley, Park HQ

Planned Acres: 2000

Planned Dates: start → June; end → October

Smoke Emissions: Veg. Type – Ponderosa Pine, pine oak woodland

Estimated tons per Acre –

Planned tons per acre consumption –

5. North Slope Burn Unit

Project Number 0005

Purpose: This unit was burned in the 2003 Helens2 wildfire. Active fire suppression over the last century caused a buildup of fuels to above normal loads of over 44 tons/acre. Severity maps show that a high percentage of the area burned intensely with many trees and shrubs being killed. Tree ring analysis show a fire frequency prior to the 1900's of ever 9.9 years in the mixed conifer type of Mica Mountain. This type is the primary habitat for MSO's in the Rincon Mountains. This second entry burn would be used primarily as a way to reduce the dead and down fuel loading that will occur over the next several years from the Helens2 wildfire. By using fire in this area we will reduce fuel loads which will reduce the chance for a catastrophic wildland fire that would have the potential to destroy MSO nesting sites as well as cause increased amounts of erosion and sedimentation, which can affect tinajas which are critical for the survival of many species in the Sonoran desert. By using fire in an ecologically appropriate manner such as this, this area will eventually be able to safely accept managed wildland fire.

Predominant Vegetation Types: Mixed conifer, Douglas fir, and Ponderosa Pine

Location: Rincon Mountain District. North slope of Mica Mountain, from top of Mica Mountain to northern boundary of park. Burn will be conducted with cooperation of Coronado National Forest.

Latitude: 32° 13', *Longitude:* 110° 33'

Township 14S, *Range* 17E and *Range* 18E, sec. 1,2,3,10,11,12,13,14,15/6,7,18

Elevation Range: 4,600' to 8,666'

Aspect: North

Condition Class:3

Activities: Understory Burn

Compliance Issues: Mexican spotted owl, leopard frogs

Smoke Sensitive Areas: Tucson Basin, Manning Camp, Rincon Valley, Park HQ

Planned Acres: 4400

Planned Dates: start→ September; end→ November
Smoke Emissions: Veg. Type – Ponderosa Pine
Estimated tons per Acre –
Planned tons per acre consumption –

Five Year Monitoring Schedule

<i>Plot Name</i>	<i>2003</i>	<i>2004</i>	<i>2005</i>	<i>2006</i>	<i>2007</i>
FQUHY10923	02 YR 1	02 YR 2			02 YR 5
FQUHY10903		02 PRE/POST	02 YR 1	02 YR 2	
FQUHY10902		02 PRE/POST	02 YR 1	02 YR 2	
FQUAR10912				01 PRE/POST	01 YR 1
FQUAR10911				01 PRE/POST	01 YR 1
FQUAR10910				01 PRE/POST	01 YR 1
FQUAR10909				01 PRE/POST	01 YR 1
FQUAR10908				01 PRE/POST	01 YR 1
FQUAR10907				01 PRE/POST	01 YR 1
FQUAR10906				01 PRE/POST	01 YR 1
FQUAR10905				01 PRE/POST	01 YR 1
FQUAR10904				01 PRE/POST	01 YR 1
FQUAR10903				01 PRE/POST	01 YR 1
FQUAR10902				01 PRE/POST	01 YR 1
FQUAR10901				01 PRE/POST	01 YR 1
FQUAR10610	01 YR 5				02
PRE/POST					
FQUAR10609	01 YR 5				02
PRE/POST					
FQUAR10608	01 YR 5				02
PRE/POST					
FQUAR10607	01 YR 5				02
PRE/POST					
FQUAR10606	01 YR 5				02
PRE/POST					
FQUAR10605	01 YR 5				02
PRE/POST					
FQUAR10604	01 YR 5				02
PRE/POST					
FQUAR10603	01 YR 5				02

PRE/POST

FQUAR10602	01 YR 5					02
PRE/POST						
FQUAR10601	01 YR 5					02
PRE/POST						
FPSME1110	01 POST	01 YR 1	01 YR 2			
FPSME1109	01 POST	01 YR 1	01 YR 2			
FPSME1110	01 POST	01 YR 1	01 YR 2			
<i>Plot Name</i>	<i>2003</i>	<i>2004</i>	<i>2005</i>	<i>2006</i>		<i>2007</i>
FPSME1107	01 POST	01 YR 1	01 YR 2			
FPSME1106	01 POST	01 YR 1	01 YR 2			
FPSME1105	01 POST	01 YR 1	01 YR 2			
FPSME1104	01 POST	01 YR 1	01 YR 2			
FPSME1103	01 POST	01 YR 1	01 YR 2			
FPSME1102	01 POST	01 YR 1	01 YR 2			
FPSME1101	01 POST	01 YR 1	01 YR 2			
FPIPO10930	01 YR 5					02
PRE/POST						
FPIPO10929	01 YR 5					02
PRE/POST						
FPIPO10928	01 YR 5					02
PRE/POST						
FPIPO10927	02 YR 1	02 YR 2				02 YR 5
FPIPO10926	02 YR 1	02 YR 2				02 YR 5
FPIPO10925	02 YR 1	02 YR 2				02 YR 5
FPIPO10924	02 YR 1	02 YR 2				02 YR 5
FPIPO10922	02 YR 1	02 YR 2				02 YR 5
FPIPO10921				01 PRE/POST		01 YR 1
FPIPO10920		02 PRE/POST	02 YR 1	02 YR 2		
FPIPO10919		02 PRE/POST	02 YR 1	02 YR 2		
FPIPO10918		02 PRE/POST	02 YR 1	02 YR 2		
FPIPO10917	02 YR 1	02 YR 2				02 YR 5

FPIPO10916	02 YR 1	02 YR 2	02 YR 5
FPIPO10915	02 YR 1	02 YR 2	02 YR 5
FPIPO10914	02 YR 1	02 YR 2	02 YR 5
FPIPO10913	02 YR 1	02 YR 2	02 YR 5
FPIPO10912	02 YR 1	02 YR 2	02 YR 5
FPIPO10911		02 PRE/POST 02 YR 1	02 YR 2
FPIPO10910	02 YR 1	02 YR 2	02 YR 5
FPIPO10909	02 YR 1	02 YR 2	02 YR 5
FPIPO10908	02 YR 1	02 YR 2	02 YR 5
FPIPO10906	02 YR 1	02 YR 2	02 YR 5

<i>Plot Name</i>	<i>2003</i>	<i>2004</i>	<i>2005</i>	<i>2006</i>	<i>2007</i>
FPIPO10905		02 YR 1	02 YR 2		
FPIPO10904		02 YR 1	02 YR 2		
FPIPO10903	02 YR 1	02 YR 2			02 YR 5
FPIPO10902	02 YR 1	02 YR 2			02 YR 5
FPIPO10901	02 YR 1	02 YR 2			02 YR 5
FPILE10410			INSTALL	01 PRE/POST	01 YR 1
FPILE10409			INSTALL	01 PRE/POST	01 YR 1
FPILE10408			INSTALL	01 PRE/POST	01 YR 1
FPILE10407				01 PRE/POST	01 YR 1
FPILE10406				01 PRE/POST	01 YR 1
FPILE10405				01 PRE/POST	01 YR 1
FPILE10404				01 PRE/POST	01 YR 1
FPILE10403				01 PRE/POST	01 YR 1
FPILE10402				01 PRE/POST	01 YR 1
FPILE10401				01 PRE/POST	01 YR 1
EAST SLOPE10		INSTALL	01 PRE/POST	01 YR 1	01 YR 2
EAST SLOPE9		INSTALL	01 PRE/POST	01 YR 1	01 YR 2
EAST SLOPE8		INSTALL	01 PRE/POST	01 YR 1	01 YR 2
EAST SLOPE7		INSTALL	01 PRE/POST	01 YR 1	01 YR 2
EAST SLOPE6		INSTALL	01 PRE/POST	01 YR 1	01 YR 2
EAST SLOPE5		INSTALL	01 PRE/POST	01 YR 1	01 YR 2
EAST SLOPE4		INSTALL	01 PRE/POST	01 YR 1	01 YR 2
EAST SLOPE3		INSTALL	01 PRE/POST	01 YR 1	01 YR 2
EAST SLOPE2		INSTALL	01 PRE/POST	01 YR 1	01 YR 2
EAST SLOPE1		INSTALL	01 PRE/POST	01 YR 1	01 YR 2

APPENDIX 4
SAGUARO NATIONAL PARK
FIRE MANAGEMENT OFFICE
5- YEAR BURN PLAN

This document describes the park’s prescribed fire operations program for the next 5 years. Delays in project approvals, wildland fire impacts or other factors could require modification of this schedule.

Other projects that will be occurring to coincide with successful completion of our prescribed burn efforts will be:

- Installing Fire Effects Plots in first entry burn units as needed in order to assess fuel loading reduction objectives and other related fire effects objectives.
- Re- reading Fire Effects Plots in 2nd entry burn units to assess whether burn objectives are being met.
- Tracking fuel moisture conditions for prescribed fire operations and preparedness planning.

Burn Unit Priority Analysis:

Burn unit execution priorities may shift throughout the life of this plan. The park’s program is ambitious and there are limits to the number of units and amount of acres that can be burned. The largest impact and limiting factor affecting prescribed fire operations is annual fire workload, (wildland fire and prescribed fire). Other limiting factors are seasonal weather, drought, preparedness levels, and funding.

The Fire Management Office will continually analyze the park’s manageable fire load based on the following factors:

- Are there constraints dictated by regional and national preparedness levels?
- Will the fire meet hazard fuel reduction and/or natural resources management goals?
- Will the fire cause excessive fire personnel workload and fatigue, which could result in poor decisions with accompanying increases in risks to personnel?
- What is the likelihood of the prescribed fire escaping control?
- Will there be adequate availability of contingency resources?
- Will there be project (burn unit) funding available?

Overall park burning priorities are established in this document as a guide to facilitate the most efficient use of resources, and burn unit execution scheduling, in order to accomplish hazard fuels reduction and ecosystem restoration and maintenance in the areas at highest risk. The outside observer should keep in mind that dozens of variables must be considered continuously throughout the course of the fire season in order to realistically forecast burn units that can be successfully completed.

Prescribed Burn Unit Priority Order:

#	UNIT NAME	SIZE (acres)	SEASON	NOTES
1	Devil’s Bathtub	550	Summer, fall ok	2 nd Entry
2	East Slope	400	Fall	1 st Entry
3	Saddle	2000	Summer, fall ok	1 st Entry

4	Chimenea	2000	Summer, fall ok	2 nd Entry
5	North Slope	3000	Fall	2 nd Entry

Burn Unit Descriptions:

1. Devil’s Bathtub Burn Unit

Project Number 0001

Purpose: This unit was last burned in the fall of 1997. It is comprised primarily of ponderosa pine forest with pine- oak forests located at the lower elevations. The fire regime for this area is dominated by a regular pattern of widespread ground fires with a mean fire interval of every 6 years. Historic fire occurrence appears to have been confined to the late spring and early summer. The primary purpose of this project is to restore the natural fire regime to reduce hazardous fuel buildup caused by over a century of fire suppression. This action will provide for quality Mexican Spotted Owl (MSO) habitat by reducing the chance for catastrophic fire. It will provide for openings, which will increase the native herbaceous cover required for food and habitat for a number of other species including prey species for the MSO. These natural “gaps” will provide natural fuel breaks for an otherwise continuous canopy layer. It will reduce ladder fuels, which will keep wildland fires out of the forest canopy. By introducing fire in such an ecologically appropriate manner, this area will once again be able to safely accept managed wildland fire.

Predominant Vegetation Types: Ponderosa Pine

Location: Rincon Mountain District. Southwest facing slope of Mica Mountain, southeast of Manning Cabin. North of Devil’s Bathtub Spring.

Latitude: 32° 12’, *Longitude:* 110° 32’

Township 14S, *Range* 18E, sec. 19

Elevation Range: 7,600’ to 8,200’

Aspect: South and West

Condition Class:2

Activities: Understory Burn

Compliance Issues: Mexican spotted owl

Smoke Sensitive Areas: Tucson Basin, Manning Camp, Rincon Valley, Park HQ

Planned Acres: 550

Planned Dates: start→ June; end→ October

Smoke Emissions: Veg. Type – Ponderosa Pine

Estimated tons per Acre –

Planned tons per acre consumption –

2. East Slope Burn Unit

Project Number 0002

Purpose: Historically this area has seen more fire than most areas in the park according to the Park’s fire atlas. At this time, this area has not had fire in it since 1994. Parts of this unit are habitat for MSO’s as well as Peregrine falcons. Located within the unit is a well established aspen stand which has been maintained historically by fire. Restoring fire into this area after 11 years of fire exclusion will closely mimic the occurrence seen in the fire atlas. This will reduce fuel buildup, decrease erosion and sedimentation impacts, and maintain the aspen stand. By reducing the fuel load and some of the smaller diameter trees, the chance for a catastrophic fire will decrease eventually allowing for managers to use managed wildland fire here.

Predominant Vegetation Types: Mixed conifer, Douglas fir, Aspen and Ponderosa Pine

Location: Rincon Mountain District. East slope of Mica Mountain, from Fire Loop Trail at Mica 2^{ndary} to Reef Rock down the east slope.

Latitude: 32° 12', *Longitude:* 110° 31'

Township 14S, *Range* 18E, sec. 17, 18

Elevation Range: 7,600' to 8,400'

Aspect: East

Condition Class: 3

Activities: Understory Burn

Compliance Issues: Mexican spotted owl

Smoke Sensitive Areas: Tucson Basin, Manning Camp, Rincon Valley, Park HQ

Planned Acres: 400

Planned Dates: start→ September; end→ October

Smoke Emissions: Veg. Type – Mixed conifer, Douglas fir, aspen

Estimated tons per Acre –

Planned tons per acre consumption -

3. Saddle Burn Unit - 2006

Project Number 0003

Purpose: 1st Entry Burn. Restore ponderosa pine and pine/oak forest condition to within the natural range of variability and reduce the risk of catastrophic stand replacing fire occurring over a large area. Restore fire for ecosystem management reasons. Place area into a re-burn schedule that approximates the natural fire cycle in order to maintain reduced fuels and a more natural ecosystem structure. Portions of this unit may be managed with natural fire after hazard fuels are reduced with prescribed fire.

Predominant Vegetation Types: Ponderosa Pine, oak woodland

Location: Rincon Mountain District. Southwest slope of Mica Mountain, from area south of Devil's Bathtub Spring, west of trail to Happy Valley Lookout.

Latitude: 32° 11', *Longitude:* 110° 32'

Township 14S, *Range* 17E and *Range* 18E, sec. 25,26,35,36/30,31,32

Elevation Range: 6,000' to 7,600'

Aspect: South and West

Condition Class:2

Activities: Understory Burn

Compliance Issues: leopard frogs, drainages

Smoke Sensitive Areas: Tucson Basin, Manning Camp, Rincon Valley, Park HQ

Planned Acres: 2000

Planned Dates: start→ June; end→ October

Smoke Emissions: Veg. Type – Ponderosa Pine, pine/oak woodland

Estimated tons per Acre –

Planned tons per acre consumption -

4. Chimenea Burn Unit

Project Number 0004

Purpose: 2nd Entry Burn. Maintain healthy ponderosa pine and pine- oak forest. Provide quality Mexican Spotted Owl habitat. Restore fire for ecosystem management reasons. Place area into a re-burn schedule that approximates the natural fire cycle in order to maintain reduced fuels and a more natural ecosystem structure. Portions of this unit may be managed with natural fire after hazard fuels are reduced with prescribed fire.

Predominant Vegetation Types: Ponderosa Pine

Location: Rincon Mountain District. Area west of Manning Cabin and encompassed by Cow Head Saddle Trail on the north side, and Manning Camp Trail on the south side. Grass Shack will serve as the western most boundary.

Latitude: 32° 12', *Longitude:* 110° 34'

Township 14S, *Range* 17E, sec. 13,14,22,23,24,27

Elevation Range: 5,600' to 8,000'

Aspect: South and West

Condition Class: 2

Activities: Understory Burn

Compliance Issues: Mexican spotted owl, leopard frogs, and drainages

Smoke Sensitive Areas: Tucson Basin, Manning Camp, Rincon Valley, Park HQ

Planned Acres: 2000

Planned Dates: start → June; end → October

Smoke Emissions: Veg. Type – Ponderosa Pine, pine oak woodland

Estimated tons per Acre –

Planned tons per acre consumption –

5. North Slope Burn Unit

Project Number 0005

Purpose: This unit was burned in the 2003 Helens2 wildfire. Active fire suppression over the last century caused a buildup of fuels to above normal loads of over 44 tons/acre. Severity maps show that a high percentage of the area burned intensely with many trees and shrubs being killed. Tree ring analysis show a fire frequency prior to the 1900's of ever 9.9 years in the mixed conifer type of Mica Mountain. This type is the primary habitat for MSO's in the Rincon Mountains. This second entry burn would be used primarily as a way to reduce the dead and down fuel loading that will occur over the next several years from the Helens2 wildfire. By using fire in this area we will reduce fuel loads which will reduce the chance for a catastrophic wildland fire that would have the potential to destroy MSO nesting sites as well as cause increased amounts of erosion and sedimentation, which can affect tinajas which are critical for the survival of many species in the Sonoran desert. By using fire in an ecologically appropriate manner such as this, this area will eventually be able to safely accept managed wildland fire.

Predominant Vegetation Types: Mixed conifer, Douglas fir, and Ponderosa Pine

Location: Rincon Mountain District. North slope of Mica Mountain, from top of Mica Mountain to northern boundary of park. Burn will be conducted with cooperation of Coronado National Forest.

Latitude: 32° 13', *Longitude:* 110° 33'

Township 14S, *Range* 17E and *Range* 18E, sec. 1,2,3,10,11,12,13,14,15/6,7,18

Elevation Range: 4,600' to 8,666'

Aspect: North

Condition Class: 3

Activities: Understory Burn

Compliance Issues: Mexican spotted owl, leopard frogs

Smoke Sensitive Areas: Tucson Basin, Manning Camp, Rincon Valley, Park HQ

Planned Acres: 4400

Planned Dates: start → September; end → November

Smoke Emissions: Veg. Type – Ponderosa Pine

Estimated tons per Acre –
Planned tons per acre consumption –

APPENDIX 5

Implementation Guidelines

Operations

Fire Lining Phase

- Select procedures, tools, and equipment that least impact the environment.
- Give serious consideration to the use of water as a fireline tactic.
- If there is a risk that hose coming direct from a local unit's cache is contaminated with noxious weed seeds, order fresh hose from the regional cache.
- Resource Advisors, Operations Chief, and Logistics Chief should be cognizant of any equipment that is being moved from a non- wilderness fire to a wilderness fire and make attempts to clean equipment of noxious weed seeds prior to it being used in tile wilderness.

Ground Fuels:

- Allowing fire to burn to natural barriers.
- Use cold- trail, wet line or combination when appropriate. Constantly recheck.
- If constructed fireline is necessary, use minimum width and depth to check- fire spread.
- Consider the use of fireline explosives for line construction to meet the need for more naturally appearing stumps.
- Burn out and use low impact tools like swatter or 'gunny' sack.
- Minimize bucking and cutting of trees to establish fireline; Preferably move or roll material out of the intended constructed fireline area. If moving or rolling is not possible, or the down log is already on fire, build line around the log and let it be consumed.
- Use alternative mechanized equipment such as excavators, rubber tired skidders, etc. rather than tracked vehicles. Use high pressure type sprayers on equipment prior to assigning to incident to help prevent spread of noxious weeds.
- Constantly re- check cold trailed fireline.

Aerial Fuels, Brush, Trees, and Snags:

- Limb vegetation adjacent to the fireline only as needed to prevent additional fire spread.
- During fireline construction, cut shrubs or small trees only when necessary. If tree cutting occurs, cut stumps flush with the ground and camouflage the cut surface with soil or brush.
- Minimize felling or trees and snags unless they threaten the fireline or seriously endanger workers. In lieu of falling, identify hazard trees with either a lookout or flagging. Use glow-sticks during night operations.
- Scrape around tree bases near fireline if hot and likely to cause fire spread.

Indirect Attack:

- Do not fail snags outside the constructed fireline, unless they are an obvious safety hazard to crews working in the vicinity.
- On the intended burn- out side of the line, fall only those snags that would reach the fireline should they burn and fall over. Consider alternative means to falling, i.e. fireline explosives or bucket drops.
- Review consideration listed above for aerial fuels, brush, trees and snags.

Mop- Up Phase

Ground Fuels:

- Do minimal spading; restrict spading to hot areas near the fireline.

- Cold- trail charred logs near the fireline; do minimal tool scarring.
- Minimize bucking of logs to extinguish fire or to check for hotspots; roll the logs instead if possible.
- Return logs to original position after checking and when ground is cool.
- Refrain from making bone yards; burned and partially burned fuels that were moved should be returned to a natural arrangement.
- Consider allowing large logs to burn out. Use a lever rather than bucking to manage large logs which must be extinguished.
- Use gravity socks in stream sources and/or combination of water blivits and fold- a- tanks to minimize impacts to streams.
- Personnel should avoid using rehabilitated firelines as travel corridors whenever possible because of potential soil compaction and possible detrimental impacts to rehab work, i.e. water bars.
- Do not bring in any non- native materials to be used for sediment traps in streams. Use of non- native materials creates a risk that noxious weeds will be introduced to the area.
- Place absorbent cloth under pumps to avoid spilling fuel on the ground.
- Consider using infrared detection devices along perimeter (aerial or hand- held).

Aerial Fuels:

- Remove or limb only those fuels which if ignited have potential to spread fire outside the fireline.
- Before felling consider allowing ignited tree/snag to burn itself out. Ensure adequate safety measures are communicated if this option is chosen.
- Identify hazard trees with a lookout or flagging.
- If burning trees/snags pose a serious threat of spreading fire brands, extinguish fire with water or dirt whenever possible. Consider felling by blasting when feasible. Felling by cross- cut or chainsaw should be the last resort.
- Align saw cuts to minimize visual impacts from more heavily traveled corridors. Slope cut away from line of sight when possible.

Logistics

Establishing and Setting Up Camp

- Whenever possible, avoid establishing spike or coyote camps in Wilderness. If Wilderness camps are unavoidable, use existing campsites where available.
- Coordinate with the Resource Advisor in choosing a site with the most reasonable qualities of resource protection and safety concerns. Select sites that are unlikely to be observed by Wilderness visitors. Avoid camping in wet meadows, along streams, or on lake shores.
- Consider impacts on both present and future visitors. An agency commitment to wilderness values will promote those values to the public.
- Layout camp components carefully from the start. Define cooking, sleeping, latrine, and water supplies.
- Limit travel ways within, to, and from camp.

- Minimize disturbance to land in preparing bedding and campfire sites. Do not clear vegetation, trench, or excavate a flat spot to create bedding sites.
- In small camp situations (1 crew), individuals should use the "cat-hole" method of disposing of human waste. Toilet sites should be located a minimum of 200 feet from water sources. Holes should be dug 6- 8 inches deep.
- If a large number of firefighters are using a spike camp and the camp is being serviced by helicopter, fly in portable backcountry latrines, and fly out human waste as necessary. If the camp does not have air support, establish community latrines well away from water sources, rather than leaving it up to the individual.
- Place indoor- outdoor carpet, scrap, or other material on the ground to protect vegetation in the most heavily traveled areas of camp, i.e.: kitchen, campfire, and washing- up areas.
- Use stoves for cooking. If a campfire is built for warmth in the evening, build either a pit or mound fire. A fire shelter placed beneath the coals provides extra protection for the soil.
- If a large camp is employed, designate a common area for personnel to wash up. Provide fresh water, biodegradable soap, and a place for waste water.
- In small spike camps or coyote camps, carry water and bathe away from lakes and streams. Do not introduce soap, shampoo, or other personal grooming chemicals into waterways.
- Devise a plan for disposing of waste water from kitchen and washing areas.
- Store food properly so that it is not accessible to wildlife. Consider hanging food in trees at least 15 feet off the ground and 5 feet from the trunk of the tree, or store food in sealable containers. Store food away from the campsite (300 feet is ideal) to reduce the risk of human and bear conflicts.
- Do not let garbage and food scraps accumulate in camp. All garbage and food scraps need to be removed from the camp on a regular basis if the camp is being served by a helicopter, or properly stored if frequent removal is not possible.
- Resource advisors should work with cache personnel during the off- season to ensure that tents are cleaned of any noxious weed seeds prior to being sent to a wilderness fire.

Personal Camp Conduct

- Use "Leave No Trace" camping techniques
- Minimize disturbance to land when preparing bedding and campfire sites. Do not clear vegetation, trench, or excavate a flat spot to create bedding sites.
- Use established latrines where provided. If latrines are not available use the "cat-hole" method of disposing of human waste. Toilet sites should be located a minimum of 200 feet from water sources. Holes should be dug 6- 8 inches deep.

- If a campfire is built for warmth in the evening, build either a pit or mound fire. A fire shelter placed beneath the coals provides extra protection for the soil. Avoid using rocks to ring fires.
- Use dead and down firewood. Use small diameter wood that burns down more cleanly. Don't burn plastics or aluminum - pack it out with the rest of the camp garbage.
- If a designated personal washing area is not provided, carry water and bathe away from lakes and streams. Do not introduce soap, shampoo, or other personal grooming chemicals into waterways.
- Keep a clean camp and store food and garbage so it is unavailable to bears. Ensure items such as empty food containers are clean and odor free, never bury them.
- Do not use nails in trees.
- Constantly evaluate the impacts that will occur, both short and long term.

Aviation Management

One of the goals of wilderness managers is to minimize the disturbance caused by air operations during an incident.

Helispot Construction

- Wherever possible, locate helibases in weed free areas, to prevent the transport of noxious weeds into wilderness.
- When planning for helispots, determine the primary function of each helispot, i.e.: crew shuttle, logistical support, or both.
- If a helispot is only needed for logistical support to deliver and retrieve supplies or gear, consider using a long line remote hook in lieu of constructing a helispot.
- If a helispot is needed for crew shuttle, consider the minimum size helicopter that could do the job, if you have an option, and still meet suppression objectives.
- Use natural openings as much as possible. If some tree falling or cribbing is necessary, avoid high visitor use locations unless the modifications can be rehabilitated to be generally unnoticeable. Feather the opening so that it appears more natural looking. Consider directional falling of trees and snags.
- Buck and limb only what is necessary to achieve safe/practical operating space in and around the landing pad areas.
- Perform an aerial reconnaissance of the fire area and select potential helispots. In determining helispot locations, involve, at a minimum, the Air Operations Manager, responsible land manager or Resource Advisor, and the Helitack Foreman. Consider drawing a sketch and

discuss which trees need to be cut to ensure a safe operation for the size of the helicopter deemed necessary or available.

- If a high level of resource impact is anticipated from a proposed helispot, evaluate carefully whether it is absolutely necessary and if there isn't an alternative Outside Wilderness.
- Provide specific instructions for the on-the-ground foreman and crew to use when constructing the agreed upon helispot.
- Whenever possible, the resource advisor should observe the construction of a helispot.

Retardant Use

- During initial attack, fire managers must weigh the non-use of retardant with the probability of initial attack crews being able to successfully control and contain a wildfire. If it is determined that use of retardant may prevent a larger, more damaging wildfire, then the manager might consider retardant use even in sensitive areas. This decision must take into account all values at risk and the consequences of larger firefighting forces' impact on the land.
- Consider impacts of water drops versus use of foam/retardant. If foam/retardant is deemed necessary, consider use of foam before retardant use.

Hazardous Materials

Flammable / Combustible Liquids

- Store and dispense aircraft and equipment fuels in accordance with the National Fire Protection Association (NFPA) and Health and Safety Code Handbook requirements.
- Avoid spilling or leakage of oil or fuel, from sources such as portable pumps, into water sources or soils.
- Store and liquid petroleum gas (Propane) downhill and downwind from fire camps and away from ignition sources.

Flammable Solids

- Pick up residual fusee debris from the fireline and dispose of properly.

Fire Retardant / Foaming Agents

- Do not drop retardant or other suppressants near surface waters.
- Use caution when operating pumps or engines with foaming agents to avoid contamination of water sources.

Fireline Explosives

- Remove all undetonated fireline explosives from storage areas and fireline at the conclusion of the incident and dispose of according to Bureau of Alcohol, Tobacco and Firearms (BATF) and Fireline Blaster Handbook requirements. Properly dispose of all packaging materials.

Fire Rehabilitation

Rehabilitation is a critical need. This need arises primarily because of the impacts associated with fire suppression and the logistics that support it. The process of constructing control lines, transport of personnel and materials, providing food and shelter for personnel, and other suppression activities has a significant impact on sensitive resources regardless of the mitigating measures used. Therefore, rehabilitation must be undertaken in a timely, professional manner.

During implementation, the resource advisor should be available for expert advise and support of personnel doing the work as well as quality control.

Rehabilitation Guidelines

- Pick up and remove all flagging, garbage, litter, and equipment. Dispose of trash appropriately.
- Clean fire pit of unburned materials and fill back in.
- Discourage use of newly established trails created during the suppression effort by veering with brush, limbs, small diameter poles, and rotten logs in a naturally appearing arrangement
- Replace dug- out soil and/or duff and obliterate any berms created during the suppression efforts.
- If impacted trails have developed slopes greater than six percent (6%), construct waterbars according to the following spacing guide:

Trail Percent Grade	Maximum Spacing Ft.
6- 9	400
10- 15	200
15- 25	100
25+	50

- Where soil has been exposed and compacted, such as in camps, on user- trails, at helispots and pump sites, scarify the top 2- 4 inches and scatter with needles, twigs, rocks, and dead branches. It is unlikely that seed and fertilizer for barren areas will be appropriate, in order to maintain the genetic integrity of the area. It may be possible, depending on the time of year and/or possibility of a rainy period, to harvest and scatter nearby seed, or to transplant certain native vegetation.
- Blend campsites with natural surroundings, by filling in and veering latrine with soil, rocks, and other natural material. Naturalize campfire area by scattering ashes in nearby brush (after making sure any sparks are out) and returning site to a natural appearance.
- Where trees were cut or limbed, cut stumps flush with ground, scatter limbs and boles, out of sight in unburned area. Camouflage stumps and tree boles using rocks, dead woody material,

fragments of stumps, bolewood, limbs, soil and fallen or broken green branches. Scattered sawdust and shavings will assist in decomposition and by less noticeable. Use native materials from adjacent, unimpacted areas if necessary.

- Remove newly cut tree boles that are visible from trails or meadows. Drag other highly visible woody debris created during the suppression effort into timbered areas and disburse. Tree boles that are too large to move should be slant cut so a minimal amount of the cut surface is exposed to view. Chopping the surface with an axe or Pulaski, to make it jagged and rough, will speed the natural decomposition.
- Leave tops of felled trees attached. This will appear more natural than scattering the debris.
- Consider using explosives on some stumps and cut faces of the bolewood for a more natural appearance.
- Consider, if no other alternatives are available, helicopter sling loading rounds and tops from a disturbed site when there has been an excessive amount of bucking, limbing, and topping.
- Tear out sumps or dams, where they have been used, and return site to natural condition. Replace any displaced rocks or streambed material that has been moved. Reclaim streambed to its predisturbed state, when appropriate.
- Walk through adjacent undisturbed area and take a look at your rehab efforts to determine your success at returning the area to as natural a state as possible. Good examples should be documented and shared with others!

Demobilization

Because demob is often a time when people are tired or when weather conditions are less than ideal, enough time must be allowed to do a good job. When moving people and equipment, choose the most efficient and least impactful method to both the landscape and fire organization mission. An on- the- ground analysis of “How Things Went” will be important.

Post- Fire Evaluation

Post- fire evaluation is important for any fire occurrence so management can find out how things went. Identify areas needing improvement, to formulate strategies and to produce quality work in the future. This activity is especially important in wilderness and like sensitive areas due to their fragility and inclination to long- term damage by human impacts.

Resource advisors and functional specialists such as wilderness rangers will be responsible for conducting the post- fire evaluation. They are the people who have the experience and knowledge to provide information required to make the evaluation meaningful and productive. Post- fire evaluation will consist of data collection, documentation, and recommendations. This process and report will, in most cases, be fairly simple and to the point. It should be accomplished before an overhead team departs from the fire. The evaluation emphasis should be on the MIST actions and not the effects of the fire.

Evaluation will be completed on wildfires exceeding 100 acres and on a sample of fires less than 100 acres. It is appropriate to evaluate a diversity of fires, ranging from a spot fire suppressed by smoke chasers or jumpers to a large project fire managed by an overhead team.

Data Collection / Documentation / Recommendations

This phase will be completed by a review of the rehab plan and visit to the fire site as soon after demobilization as possible. An inventory of camps and helispots will be completed. This will also include an objective overview of other areas covered by the rehab plan.

Observations will be documented in a brief report to the lead officer with a copy to the appropriate incident commander. In the report, the evaluator will include recommendations for the ensuing fire suppression activities on similar lands. It is important that the evaluator recognize and commend the initial attack forces or overhead team for positive activities. Make special note of the extra efforts and sensitivity to suppression impacts.

APPENDIX 6
Saguaro National Park Wildland Fire Implementation Plan—WFIP

This implementation plan was developed through input from local experts and staff members at Saguaro National Park. The process described in the plan reflect specific concerns at Saguaro that have come about from past fire events that caused adverse effects to habitats/perennial water sources found in the park. The purpose of the plan is to avoid these adverse effects in the future by developing mitigation measures in the form of a step by step guide and go- no- go gauge.

The Wildland Fire Implementation Plan is a three- stage process, and is completed based on the level of risk that is associated with the fire. A wildland fire may be managed under any of the stages and need not have all stages completed.

Stage I – Initial Fire Assessment. Stage I is a decision- making process to evaluate new fire starts and assess ongoing wildland fires in the park. It establishes the foundation information critical to manage the fire, and provides the information for the initial Go/No- Go decision. Stage I consists of two distinct components. Table 1 breaksdown the elements required for the *Fire Situation Information*, and the *Initial Go/No Go Decision*.

Stage I Fire Situation Information	Initial Go/No Go Decision
Fire name	Is there a threat to life, property, or resources that cannot be mitigated?
Fire number	Are potential effects on cultural and natural resources outside the range of acceptable effects?
Jurisdiction(s)	Are relative risk indicators and/or risk assessment results unacceptable to the appropriate Agency Administrator?
Administrative unit(s)	Is there other proximate fire activity that limits or precludes wildland fire use?
Fire Management Unit (FMU)	The Decision criteria above is a process to assess whether or not the situation warrants continued wildland fire use implementation. A “yes” response to any element on the checklist indicates that the appropriate management response should be suppression- oriented.
Geographic Area(s)	
Management Code(s)	
Start date/time	
Discovery date/time	
Current size	
Location	
Cause	
Fuel model(s)/conditions	
Current weather	
Forecasted weather	
Current fire behavior	
Forecasted fire behavior	
Availability of resources	
Decision criteria checklist	

Recommended response action	
-----------------------------	--

Table 1

In addition to the general information, Table 2 will serve as a guideline for starts occurring pre-monsoon and after the monsoon pattern has been established. In addition, Table 2a will be referenced for target environmental conditions upon a pre-monsoon ignition. These guidelines will be considered during the initial fire situation and effect the go/no go decision.

Stage I Guideline	
▪ If a pre-monsoon ignition occurs that meets the defined prescription (table 2a), is above 6,000', and is in an area that has been treated with fire in the last 10 years	Go
▪ If a pre-monsoon ignition occurs below 6,000'	No Go ¹
▪ If a post monsoon ignition occurs above 4,500' in elevation	Go

Table 2

Pre-Monsoon	Temp (°F)	Relative Humidity (%)	Wind Direction	Energy Release Component	1000-hr TLFM
May 1 st – July 3 rd	≤ 105	≥ 15	WSW, W, WNW, N, S	≤ 25 FM C	≥ 8

Table 2a

Once the fire is authorized to burn it must be periodically re-assessed to confirm the continued capability to manage the fire. This must be completed regardless of whether the fire is in Stage I, II or III of the planning process. This is done based on a set time schedule not to exceed at least once every 7 days. During periods of active growth this process is done daily. This revalidation consists of completing a revalidation checklist (Fig 4) and assessing the need to perform additional planning by moving to Stage II or Stage III. The re-validation process requires a signature by the agency administrator (Superintendent).

Stage II – Short-Term Implementation Actions. Stage II represents the initiation of management for resource benefits. During this stage, the potential fire behavior is calculated; uncertainty is reduced by assessing risk (Fig 1) of the fire, how quickly it could spread, what the projected final fire size will be, how many (total) acres in the park have been burned year-to-date, projected affect on major drainages (below 6,000') and how intense the fire may burn; fire complexity; necessary immediate and short-term management actions and resources; and evaluation of the need to move directly to Stage III.

¹ If an ignition occurs between 5,000' and 6,000' with a projected growth limited to uphill spread because of topographic features or fuels, the ignition may be considered for Wildland Fire Use.

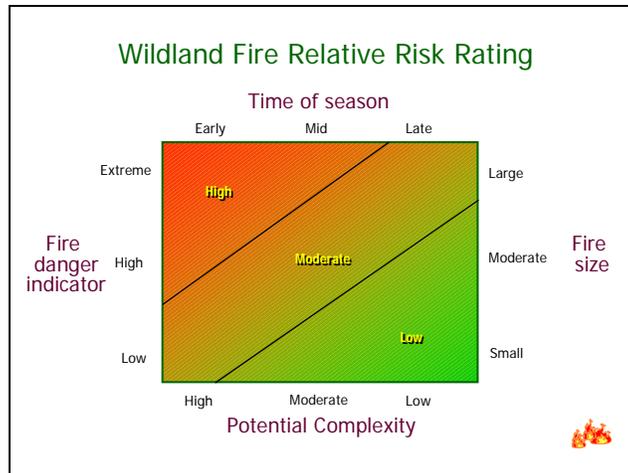


Figure 1 Wildland fire relative risk rating chart

- Stage II consists of four distinct components: *Fire Behavior Predictions and Risk Assessment*, *Short-term implementation actions*, *Complexity Rating Worksheet*, and *Stage III Needs Assessment*.
 - **Fire Behavior Predictions:** generated through the Fire Behavior Prediction System (FBPS) using the BEHAVE system to obtain predictions of fire intensity and rate of spread based on fuel model, wind, topography, and fuel moisture conditions.
 - **Risk Assessment:** A variety of techniques can provide specific estimates of degree of risk. Example products may include: probability of fire reaching Maximum Manageable Area (if MMA location is known from FMP), probability of a season- ending event, description or map of predicted fire perimeters. The minimum risk assessment required is a relative risk chart output (Fig 1).
 - **Short- Term Implementation Actions:** Developed from staff input, predicted fire behavior, risk assessment, fuel types, fuel continuity, overall objectives. Represents tactical implementation actions.
 - **Complexity Analysis:** Developed from staff input and review of standard complexity elements.
 - **Stage III Need Assessment Chart:** Determined from completion of relative risk, complexity rating, fire behavior predictions, and Fire Situation (Stage I).

Table 3 Guideline for implementation of stages II and III.

Stage II & III Guidelines

- Keep fire size below 3,000 acres for any one fire.
- Total acres burned for any one given year whether from Rx or Wildland Fire Use may be restricted to $\leq 5,000$ acres.²
- Limit the % burned of any one major drainage below 6,000' in elevation to $\leq 25\%$. (see map)

The Short- Term Implementation Actions: These actions can vary significantly, depending upon specific circumstances of the particular fire. In cases where the fire may be fuel- limited,

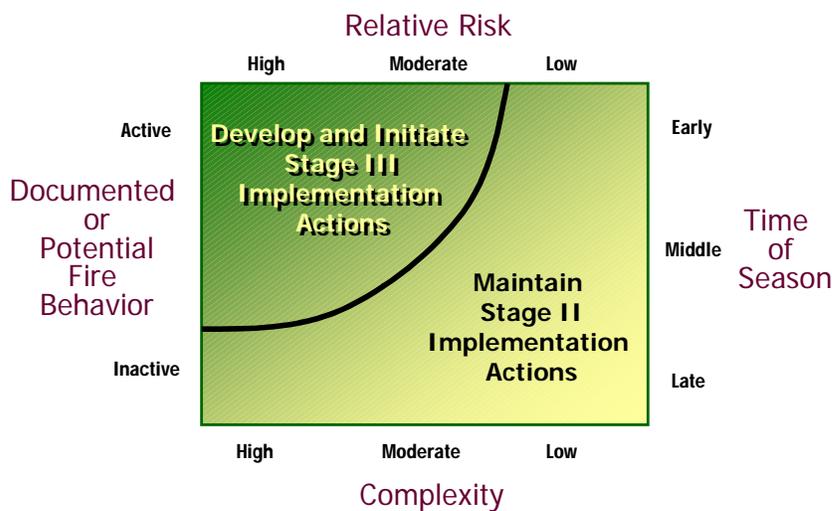
² This will be dependent on burn severity, location within the park, and time since last fire.

- Time of Season
- Documented or Potential Fire Behavior
- Complexity
- Relative Risk

All four of the above elements are known from completing the first two Stages of planning and are evaluated together to yield a visual aid which can help decide whether planning should proceed to Stage III. By matching indexes top and bottom and side to side in figure 3, the crossing point indicates the need to move to Stage III.

Stage III – Long Term Assessment and Implementation Actions. This is the final stage of the WFIP and its need is determined by the Stage III Needs Assessment Chart (Fig 3) or it can be ordered completed by the Agency Administrator (Superintendent). Stage III is normally completed on all fires that display potential for significant growth, have potential to threaten significant values, or have significant holding actions or resource commitment associated with their management. This stage is also normally always completed if a Fire Use Management Team is activated to manage the fire.

Stage III Need Assessment Chart



Stage III details operational activities and documents the planning completed to insure adequate mitigation actions have been developed. These actions will provide the best protection against fire activity exceeding acceptable limits. Mitigation actions are those on-the-ground activities that will serve to increase the defensibility of the Maximum Manageable Area (MMA), check,

Figure 3

direct, or delay the spread of fire, and minimize threats to life, property, and resources. Mitigation actions may include mechanical and physical non-fire tasks and specific fire applications. Their purpose is to construct firelines, reduce excessive fuel concentrations, reduce vertical fuel continuity, create fuel breaks or barriers around critical or sensitive sites or resources, create "blacklines" through controlled burnouts, and limited suppression actions to limit fire spread and behavior. There are 15 major components to Stage III of the WFIP:

Objectives and Risk Assessment Considerations

- Natural and Cultural resource objectives and constraints/considerations

- Maximum Manageable Area Definition and Maps
- Fire Projections and Maps
- Weather season/drought discussion and prognosis
- Long- Term Risk Assessment (describe techniques and outputs, include maps as appropriate)
- Probability of Success
- Threats
 - Threats to MMA
 - Threats to Public Use and Firefighter Safety
 - Smoke dispersion and effects
 - Other
- Monitoring Actions (actions, frequency, and duration)
- Holding Actions (describe holding actions, management action points that initiate these actions, and key to map if necessary)
- Resources needed to manage the fire
- Estimated costs of long- term implementation actions
- Contingency Actions (describe contingency actions, management action points that initiate them, and resources needed)
- Information Plan
- Post- burn evaluation
- Signatures and Date

Once again, the decision to manage a fire at Stage I, II, or III must be periodically re- assessed and validated by the agency administrator (Superintendent). This step provides a process to evaluate the continued capability of the local unit to manage the fire for resource benefits, and to determine if the fire is escalating in complexity and operational needs.

PERIODIC FIRE ASSESSMENT PART 1: RE-VALIDATION CHECKLIST	
<i>Decision Element</i>	Yes No
Is there a threat to life, property, or resources that cannot be mitigated?	<input type="checkbox"/> <input type="checkbox"/>
Are potential effects on cultural and natural resources outside the range of acceptable effects?	<input type="checkbox"/> <input type="checkbox"/>
Are relative risk indicators and/or risk assessment results unacceptable to the appropriate Agency Administrator?	<input type="checkbox"/> <input type="checkbox"/>
Is there other proximate fire activity that limits or precludes successful management of this fire?	<input type="checkbox"/> <input type="checkbox"/>
Are there other Agency Administrator Issues that preclude wildland fire use?	<input type="checkbox"/> <input type="checkbox"/>
Do expected management needs for this fire exceed known capabilities?	<input type="checkbox"/> <input type="checkbox"/>

Figure 4. The Periodic Fire Assessment is illustrated in the reduced format forms above.

Once the fire is authorized to burn, it must be periodically re-assessed to confirm the continued capability to manage the fire. This is done based on a set time schedule not to exceed at least once every 7 days. During periods of active growth this process is done daily. This revalidation consists of completing a revalidation checklist and assessing the need to perform additional planning. At Stage II the periodic re-assessment and re-validation requirement also requires that the chart (Fig 3) be evaluated each time the re-assessment is done. The re-validation process requires a signature by the agency administrator (Superintendent).

Copies of figure 2 and 4 may be obtained from the *Wildland and Prescribed Fire Management Policy Implementation Procedures Reference Guide*.