

FINAL

Simon Preserve Vegetation Management Plan

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Glossary of Terms and Acronyms

Arson Fire: A wildfire willfully ignited by anyone to burn or spread to vegetation or property without consent of the owner or his/her agent.

BEHAVE/BehavePlus: Fire behavior prediction and fuel modeling computer program designed to model fire behavior characteristics based on fuel, weather, and topographic inputs. Model outputs include flame length values, fire spotting potential, and rate of fire spread.

Brush: A collective term that refers to stands of vegetation dominated by shrubby, woody plants, or low-growing trees; usually of a vegetation type undesirable for livestock or timber management.

Brush Fire: A fire burning in vegetation that is predominantly shrubs, brush, and scrub growth.

Burning Conditions: The state of the combined factors of the environment that affect fire behavior in a specified fuel type.

Canopy: The stratum containing the crowns of the tallest vegetation present (living or dead), usually above 20 feet.

Class A Foam: Foam intended for use on Class A or woody fuels; made from hydrocarbon-based surfactant, therefore lacking the strong filming properties of Class B foam, but possessing excellent wetting properties.

Closure: Legal restriction, but not necessarily elimination, of specified activities such as smoking, camping or entry that might cause fires in a given area.

Combustible: Any material that, in the form in which it is used and under the conditions anticipated, will ignite and burn.

Condition of Vegetation: Stage of growth or degree of flammability of vegetation that forms part of a fuel complex.

Conflagration: A raging, destructive fire. Often used to describe a fire burning under extreme fire weather. The term is also used when a wildland fire burns into a wildland/urban interface, destroying structures.

Crown Fire: A fire that advances from top to top of trees or shrubs more or less independent of a surface fire.

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Defensible Space: An area, typically 100 feet wide or more, between an improved property and a potential wildfire, where the combustibles have been removed, thinned, or treated.

Duff: The layer of decomposing organic materials lying below the litter layer of freshly fallen twigs, needles and leaves and immediately above the mineral soil.

Escape Route: Route away from dangerous areas on a fire; should be pre-planned.

Evacuation: The temporary movement of people and their possessions from locations threatened by wildfire.

Exposure: (1) Property that may be endangered by a fire burning in another structure or by a wildfire; (2) Direction in which a slope faces, usually with respect to cardinal directions; (3) The general surroundings of a site with special reference to its openness to winds.

Extreme fire: A level of fire behavior characteristics that ordinarily precludes methods of direct control. One or more of the following is usually involved: high rates of spread, prolific crowning and/or spotting, presence of fire whirls, a strong convection column. Predictability is difficult because such fires often exercise some degree of influence on their environments and behave erratically, sometimes dangerously.

Fine Fuels: Fast-drying dead fuels which are less than 1/4-inch in diameter and are generally characterized by a comparatively high surface area-to-volume ratio. These fuels (grass, leaves, needles, etc.) ignite readily and are consumed rapidly by fire when dry.

Fire Behavior: The manner in which a fire reacts to the influences of fuel, weather, and topography.

Fire Danger Index: A relative number indicating the severity of wildland fire danger as determined from burning conditions and other variable factors of fire danger.

Fire Department: Any regularly organized fire department, fire protection district or fire company regularly charged with the responsibility of providing fire protection to the jurisdiction.

Fire Front: That part of a fire within which continuous flaming combustion is taking place. Unless otherwise specified it is assumed to be the leading edge of the fire perimeter.

Fire Hazard: A fuel complex, defined by volume, type condition, arrangement, and location, that determines the degree of ease of ignition and of resistance to control.

Fire Hydrant: A valved connection on a piped water supply system having one or more outlets that is used to supply hose and fire department pumpers with water.

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Fire Prevention: Activities, including education, engineering, enforcement and administration, that are directed at reducing the number of wildfires, the costs of suppression, and fire-caused damage to resources and property.

Fire Proofing: Removing or treating fuel with fire retardant to reduce the danger of fires igniting or spreading.

Fire Protection: The actions taken to limit the adverse environmental, social, political and economical effects of fire. Protection is relative, not absolute.

Fire Regime: Periodicity and pattern of naturally-occurring fires in a particular area or vegetative type, described in terms of frequency, biological severity, and area of extent.

Fire Resistant Roofing: The classification of roofing assemblies A, B or C as defined in the Uniform Building Code (UBC) Standard 32.7.

Fire Retardant: Any substance except plain water that by chemical or physical action reduces flammability of fuels or slows their rate of combustion.

Fire Season: (1) Period(s) of the year during which wildland fires are likely to occur, spread, and affect resource values sufficient to warrant organized fire management activities; (2) A legally enacted time during which burning activities are regulated by state or local authority.

Fire Storm: Violent convection caused by a large continuous area of intense fire. Often characterized by destructively violent surface indrafts, near and beyond the perimeter, and sometimes by tornado-like whirls.

Fire Suppressant: Any agent used to extinguish the flaming and glowing phases of combustion by direct application to the burning fuel.

Fire Triangle: Instructional aid in which the sides of a triangle are used to represent the three factors (oxygen, heat, fuel) necessary for combustion and flame production; removal of any of the three factors causes flame production to cease.

Fire Weather: Weather conditions which influence fire starts, fire behavior or fire suppression.

Fire Whirl: Spinning vortex column of ascending hot air and gases rising from a fire and carrying aloft smoke, debris, and flame. Fire whirls range in size from less than one foot to over 500 feet in diameter. Large fire whirls have the intensity of a small tornado.

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Firebrand: Any source of heat, natural or human made, capable of igniting wildland fuels. Flaming or glowing fuel particles that can be carried naturally by wind, convection currents, or gravity into unburned fuels. Examples include leaves, pine cones, glowing charcoal, and sparks.

Firebreak: A natural or constructed barrier used to stop or check fires that may occur, or to provide a control line from which to work.

Firefighter: A person who is trained and proficient in the components of structural or wildland fire.

Fire-Resistive Rating: The time that the material or construction will withstand fire exposure as determined by a fire test made in conformity with the standard methods of fire tests of building, construction and materials.

Firewise Landscaping: Vegetative management that removes flammable fuels from around a structure to reduce radiant heat exposure. The flammable fuels may be replaced with green lawn, gardens, certain individually spaced green, ornamental shrubs, individually spaced and pruned trees, decorative stone or other non-flammable or flame-resistant materials.

Flame: A mass of gas undergoing rapid combustion, generally accompanied by evolution of sensible heat and incandescence.

Flammability: The relative ease with which fuels ignite and burn regardless of the quantity of the fuels.

Foam: The aerated solution created by forcing air into, or entraining air in water containing a foam concentrate by means of suitably designed equipment or by cascading it through the air at a high velocity. Foam reduces combustion by cooling, moistening and excluding oxygen.

Fuel Break: An area, strategically located for fighting anticipated fires, where the native vegetation has been permanently modified or replaced so that fires burning into it can be more easily controlled. Fuel breaks divide fire-prone areas into smaller areas for easier fire control and to provide access for firefighting.

Fuel Condition: Relative flammability of fuel as determined by fuel type and environmental conditions.

Fuel Loading: The volume of fuel in a given area generally expressed in tons per acre.

Fuel Model: Simulated fuel complex for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified.

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Fuel Modification: Any manipulation or removal of fuels to reduce the likelihood of ignition or the resistance to fire control.

Fuels: All combustible material within the wildland/urban interface or intermix, including vegetation and structures.

Ground Fuels: All combustible materials such as grass, duff, loose surface litter, tree or shrub roots, rotting wood, leaves, peat or sawdust that typically support combustion.

Hazard: The degree of flammability of the fuels once a fire starts. This includes the fuel (type, arrangement, volume and condition), topography and weather.

Hazard Reduction: Any treatment of living and dead fuels that reduces the threat of ignition and spread of fire.

Hazardous Areas: Those wildland areas where the combination of vegetation, topography, weather, and the threat of fire to life and property create difficult and dangerous problems.

Ignition Probability: Chance that a firebrand will cause an ignition when it lands on receptive fuels.

Ignition Time: Time between application of an ignition source and self-sustained combustion of fuel.

Initial Attack: The actions taken by the first resources to arrive at a wildfire to protect lives and property, and prevent further extension of the fire.

Ladder Fuels: Fuels that provide vertical continuity allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease.

Mitigation: Action that moderates the severity of a fire hazard or risk.

National Fire Danger: A uniform fire danger rating system that focuses on the environmental factors that control fire behavior the moisture content of fuels.

Natural Barrier: Any area where lack of flammable material obstructs the spread of wildfires.

Noncombustible: A material that, in the form in which it is used and under the conditions anticipated, will not aid combustion or add appreciable heat to an ambient fire.

Overstory: That portion of the trees in a forest which forms the upper or uppermost layer.

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Peak Fire Season: That period of the year during which fires are expected to ignite most readily, to burn with greater than average intensity, and to create damages at an unacceptable level.

Post Fire Charite: Noncombustible material, such as ash, that is unburned and remains on site following fire.

Preparedness: (1) Condition or degree of being ready to cope with a potential fire situation; (2) Mental readiness to recognize changes in fire danger and act promptly when action is appropriate.

Prescribed Burning: Controlled application of fire to wildland fuels in either their natural or modified state, under specified environmental conditions, which allows the fire to be confined to a predetermined area, and to produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives.

Prescribed Fire: A fire burning within prescription. This fire may result from either planned or unplanned ignitions.

Property Protection: To protect structures from damage by fire, whether the fire is inside the structure, or is threatening the structure from an exterior source. The municipal firefighter is trained and equipped for this mission and not usually trained and equipped to suppress wildland fires. Wildland fire protection agencies are not normally trained nor charged with the responsibility to provide structural fire protection but will act within their training and capabilities to safely prevent a wildland fire from igniting structures.

Protection Area: That area for which a particular fire protection organization has the primary responsibility for attacking an uncontrolled fire and for directing the suppression action. Such responsibility may develop through law, contract, or personal interest of the fire protection agent. Several agencies or entities may have some basic responsibilities without being known as the fire organization having direct protection responsibility.

Red Flag Warning Conditions: A Red Flag Warning is a forecast warning issued by the United States National Weather Service to inform area firefighting and land management agencies that conditions are ideal for wildland fire ignition and propagation. After drought conditions, and when humidity is very low, and especially when high or erratic winds that may include lightning are a factor, the Red Flag Warning becomes a critical statement for firefighting agencies, which often alter their staffing and equipment resources dramatically to accommodate the forecast risk.

Response: Movement of an individual firefighting resource from its assigned standby location to another location or to an incident in reaction to dispatch orders or to a reported alarm.

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Retardant: A substance or chemical agent which reduces the flammability of combustibles.

Slope: The variation of terrain from the horizontal; the number of feet rise or fall per 100 feet measured horizontally, expressed as a percentage.

Smoke: (1) The visible products of combustion rising above a fire; (2) Term used when reporting a fire or probable fire in its initial stages.

Spotting: The ignition of unburned fuels ahead of the fire front as a result of ignition by firebrands. Spotting enhances the spread of wildfires.

Structural Fire Protection: The protection of a structure from interior and exterior fire ignition sources. This fire protection service is normally provided by municipal fire departments, with trained and equipped personnel. After life safety, the agency's priority is to keep the fire from leaving the structure of origin and to protect the structure from an advancing wildland fire. (The equipment and training required to conduct structural fire protection is not normally provided to the wildland firefighter.)

Structure Fire: Fire originating in and burning any part of all of any building, shelter, or other structure.

Suppression: The most aggressive fire protection strategy, it leads to the total extinguishment of a fire.

Surface Fuel: Fuels lying on or near the surface of the ground, consisting of leaf and needle litter, dead branch material, downed logs, bark, tree cones, and low-stature living plants.

Tree Crown: The primary and secondary branches growing out from the main stem, together with twigs and foliage.

Uncontrolled Fire: Any fire which threatens to destroy life, property, or natural resources, and (a) is not burning within the confines of firebreaks, or (b) is burning with such intensity that it could not be readily extinguished with ordinary, commonly available tools.

Understory: Low-growing vegetation (herbaceous, brush or reproduction) growing under a stand of trees. Also, that portion of trees in a forest stand below the overstory.

Urban Interface Any area where wildland fuels threaten to ignite combustible homes and structures.

Water Supply: A source of water for firefighting activities.

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Wildfire: An unplanned and uncontrolled fire spreading through vegetative fuels, at times involving structures.

Wildland: An area in which development is essentially non-existent, except for roads, railroads, power lines, and similar transportation facilities. Structures, if any, are widely scattered.

Wildland Fire: Any fire occurring on the wildlands, regardless of ignition source, damages or benefits.

Wildland Fire Protection: The protection of natural resources and watersheds from damage by wildland fires. State protection and Federal forestry or land management agencies normally provide wildland fire protection with trained and equipped personnel (the equipment and training required to conduct wildland fire protection is not normally provided to the structural fire protection firefighter).

Wildland/Urban Interface (WUI): Any area where wildland fuels threaten to ignite combustible homes and structures.

Source: www.firewise.org

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Executive Summary

Wildland fires are a common natural hazard in Southern California. Open space areas, like those found on Simon Preserve (Preserve), include large tracts of contiguous grass, shrub, and/or tree-dominated plant communities. Wildfire in these areas is strongly influenced by regional climate and local topographic conditions and ultimately affects the structure and function of these various vegetation communities (Keeley and Keeley 1984). Large wildfires have had, and will continue to have, a substantial and recurring role in native California landscapes (Keeley and Fotheringham 2003), in part because (1) native landscapes, from forest to grasslands, become highly flammable each fall, (2) the climate in the region has been characterized by fire climatologists as the worst fire climate in the United States (Keeley 2004) with Santa Ana winds occurring during autumn after a 6-month drought period each year, and (3) ignitions via anthropogenic sources have increased or are increasing in many wildland or wildland-urban interface areas. Human influences account for most of the burned acreage in Southern California (Keeley and Keeley 1984).

Wildfire suppression efforts over the last several decades may have aided the accumulation of fuels in some natural communities (Minnich 1983, Minnich and Chou 1997) resulting in larger and more intense wildfires. In response to the fuel accumulation, creating vegetation mosaics through prescribed burning or other fuel modification efforts has been thought to reduce the spread of wildfires (Minnich and Dezzani 1998). However, large fires, such as the 2003 and 2007 wildfires in San Diego County, appeared to only be minimally constrained by mosaics of varying fuel loads (Moritz et al. 2004), especially during extreme fire weather inherent to the region. The apparent combined effects of suppression policies, climate change, and prolonged drought have resulted in a situation where human intervention will likely be necessary, as feasible, to mitigate risk from wildfires and minimize ecological impacts. Based on available information and an understanding of the fire environment of the region, it is expected that large wildfires will occur again and will burn within the Preserve.

This Vegetation Management Plan has been prepared with consideration for adjacent, non-Department of Parks and Recreation (DPR) lands and the larger Preserve area and provides management recommendations and response guidance that can easily be implemented by Preserve managers and firefighting personnel, respectively. Wildfire does not adhere to ownership boundaries. As such, it is recommended that cooperation and coordination between the various landowners adjacent to the Preserve be as seamless as possible and that the implementation of similar management actions be enacted within shared watersheds for the most effective results. The Preserve fuel management unit response maps included in Appendices A-1 and A-2 of this report will be utilized under varying conditions but primarily by DPR staff and firefighting personnel under stressful and potentially threatening circumstances. The design of the maps, therefore, is intuitive and can be quickly understood by responding fire personnel who

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may not have first-hand knowledge of the Preserve. An effective fire management process will minimize the potential magnitude of negative impacts from fire suppression efforts on Preserve management goals.

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1.0 INTRODUCTION

This Vegetation Management Plan (Plan) provides a discussion of the vegetation and resulting fire environment specific to the Simon Preserve (Preserve). It also outlines fire management objectives by vegetation type and fuel management unit, and provides treatment prescriptions intended to meet the overall habitat and open space management objectives of the Preserve. Lastly, it provides information pertaining to invasive plant management and restoration activities that may be necessary for Preserve management.

Among the plans reviewed during the preparation of the Vegetation Management Plan are:

- County of San Diego – *Vegetation Management Report – A Report on Vegetation Management in the Unincorporated Area of San Diego County* (County of San Diego 2009a)
- County of San Diego – *Draft North County Multiple Species Conservation Program Framework Resource Management Plan* (County of San Diego 2009b)
- Barnett Ranch Preserve – *Wildland Fire Management Plan* (Tierra Data, Inc. and Firewise 2004)
- *William Heise Park Vegetation Management Plan* (Davey Resource Group 2006)
- Santa Ysabel Preserve – *Revised Resource Management Plan* (County of San Diego 2008).

This Plan is consistent with the County of San Diego *Vegetation Management Report* (County of San Diego 2009a), which addresses vegetation management criteria for wildland and urban areas of unincorporated San Diego County. The fire management objectives and recommendations contained herein have been developed to minimize habitat impacts while considering public and firefighter safety as top priorities. Many of the management, monitoring, research, and experimental concepts described in the County of San Diego *Vegetation Management Report* are applicable to the Preserve and, to that end, those sections are incorporated or referred to in this section.

1.1 Purpose and Need

Vegetation management objectives must address a full range of management activities that support ecosystem sustainability, values to be protected, protection of firefighters and public safety, public health and environmental issues, and consistency with resource management objectives and activities on the Preserve. This Plan outlines a framework to address the most likely and potentially impactful natural hazard, wildfire. The framework includes discussion of fire prevention, suppression, and post-suppression fire control activities within and adjacent to

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the Preserve. The intent of this section is to provide Department of Parks and Recreation (DPR) staff and fire response personnel with critical site information for emergency fire response within and immediately adjacent to the Preserve boundaries, and identify targeted fuel management actions that can be implemented as preventative measures.

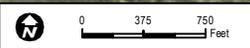
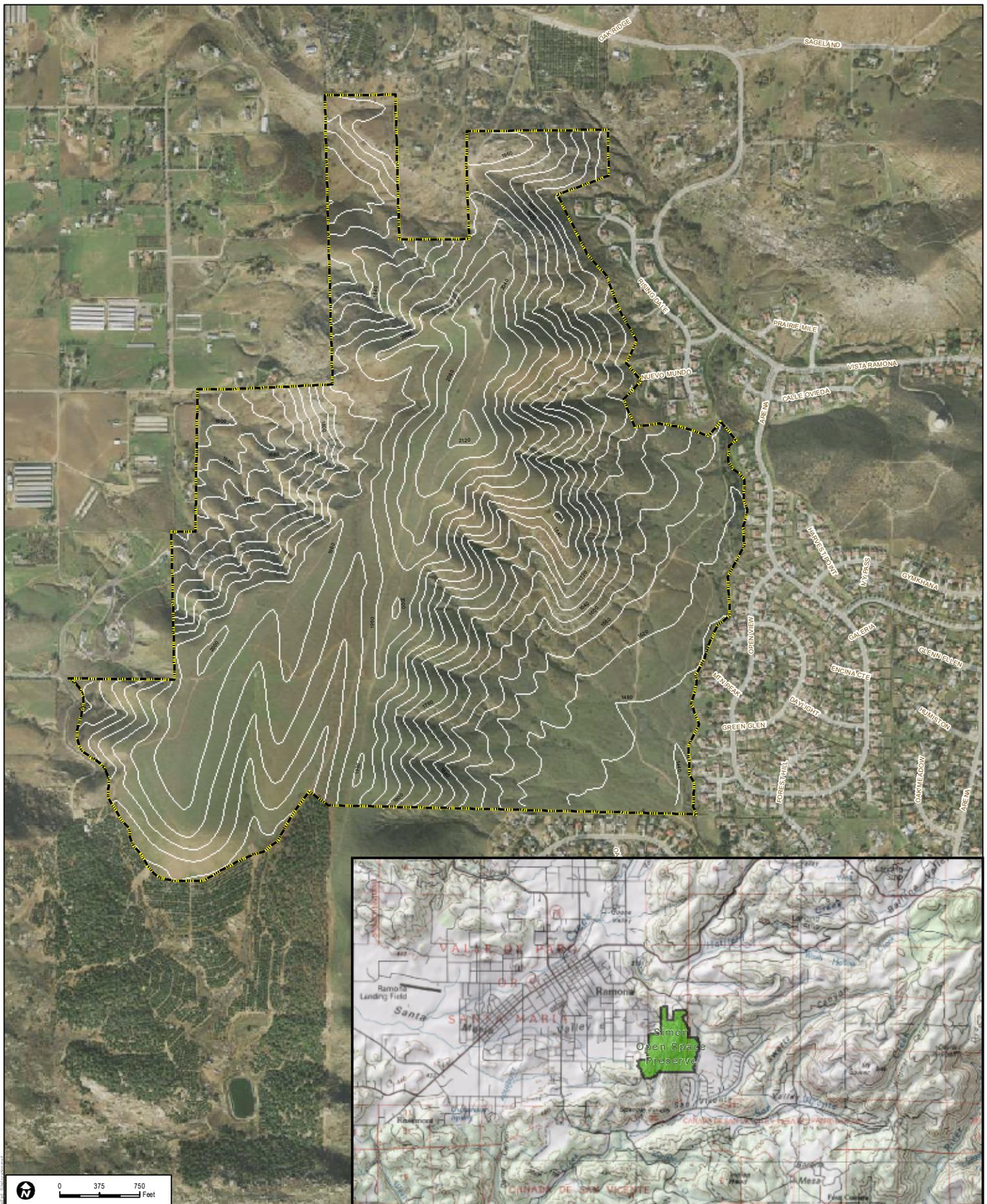
1.2 Site Location and Description

The Preserve is located in San Diego County near the unincorporated community of Ramona (Figure 1). The Preserve lies within San Diego County's North County Multiple Species Conservation Program (North County MSCP) Plan Boundary. The Preserve is also classified as a Very High Fire Hazard Severity Zone by the California Department of Forestry and Fire Protection (Cal Fire) and is bounded on the east and southeast by residential development. Low-density rural-residential development is located adjacent to the northern and western Preserve boundaries.

1.3 Vegetation Management Goals and Objectives

Fire is a natural component of the vegetation types present within the Preserve. Growing human populations in the region have increased the potential for wildfire ignitions that can alter the natural fire regime and affect vegetative cover and habitat value on the Preserve. Vegetation management goals for the Preserve are focused on ecological requirements while also emphasizing public and firefighter safety. For these reasons, planning must consider and adopt management strategies consistent with those of the larger North County MSCP (currently in draft status) and the Preserve Resource Management Plan (which will be prepared by DPR). The vegetation management goals for the Preserve include:

- Transferring critical Preserve information to the San Diego unit of Cal Fire and Ramona Fire Department firefighting personnel responsible for incident response
- Avoiding preserve-wide, catastrophic wildfires
- Restoring or enhancing the quality of degraded vegetation communities and habitat types in a manner consistent with overall species or habitat preservation goals
- Minimizing the loss of mature coastal scrub communities
- Maintaining live oak and Engelmann oak woodlands
- Developing fuel-load reduction methods that are consistent with overall Preserve management goals
- Providing for public safety through response plans and prevention activities
- Providing for adaptive fire management.



DUDEK

SOURCE: DigitalGlobe 2008; SanGIS 2007; USGS Digital Raster Graphic - Ramona Quadrangle

FIGURE 1
Site Location

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The following objectives have been formulated to achieve long-term vegetation management goals for the Preserve and desired levels of resource protection and public and firefighter safety:

- Utilize available fuel-reduction techniques, such as grazing, mowing, herbicide application, and prescribed fire, consistent with DPR goals for habitat preservation, enhancement, and restoration.
- Develop response scenarios for responding firefighters that effectively guide responders to appropriate vegetation management options for incident resolution
- Establish fuel management units (FMUs) based on topography or other clearly discernable landscape boundaries to facilitate fuel treatment or fire suppression efforts
- Establish vegetation-based fuel treatment guidelines
- Identify wildland-urban interface (WUI) areas and associated fuel management goals with a dual role of preventing wildfire from impacting urban areas and protecting the Preserve lands from fire originating in urban areas
- Provide education for local firefighting personnel regarding sensitive resources and overall management considerations associated with the Preserve
- Provide maps of sensitive biological and cultural resources to be avoided to the maximum extent possible
- Prepare Preserve maps depicting relevant fire management data, including property boundaries, topography, vegetation and fuel types, access, and other major features, including roads and structures
- Prepare fire management guidelines for each FMU, including discussion of prevention, suppression, and post-suppression activities
- Provide appropriate contact information to responding fire personnel in the event fire management activities may affect priority resources.

2.0 ENVIRONMENTAL RESOURCES

Dudek biologists conducted biological surveys for biological resources from May through October 2009. Surveys included vegetation mapping and surveys for rare and sensitive plant species and invasive non-native plant species, butterfly surveys, herpetological surveys using pitfall arrays, avian point count surveys, small mammal trapping, acoustical bat surveys, and medium- and large-mammal camera surveys.

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2.1 Biological Resources

2.1.1 Vegetation Communities

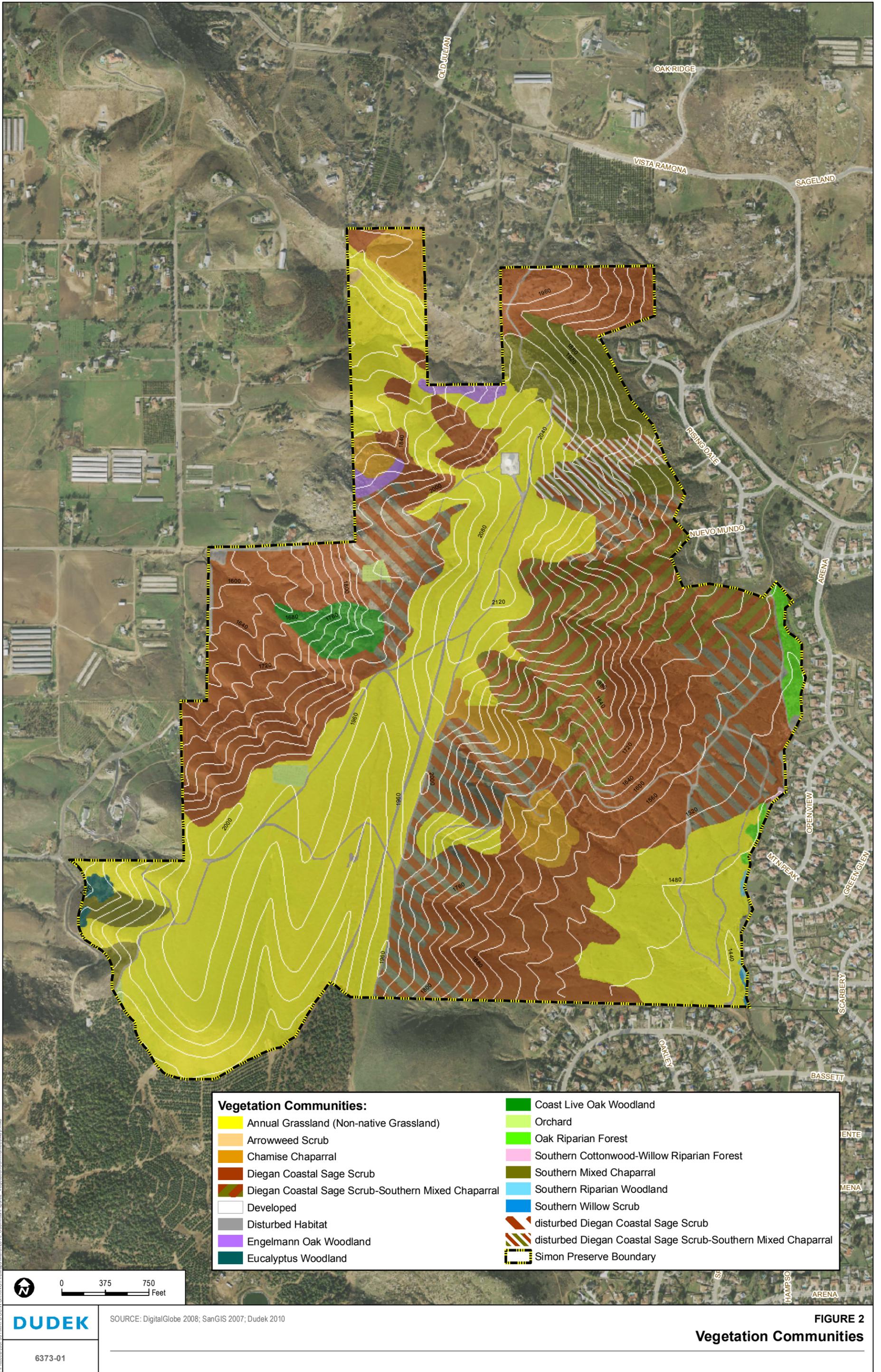
Eighteen vegetation communities and land covers (including disturbed forms) were mapped on the Preserve based on general physiognomy and species composition, including fifteen native or naturalized vegetation types and three non-native land covers (Dudek 2010; Table 1). Native or naturalized vegetation communities on site include: Diegan coastal sage scrub, disturbed Diegan coastal sage scrub, chamise chaparral, coastal sage scrub–southern mixed chaparral, disturbed coastal sage scrub–southern mixed chaparral, southern mixed chaparral, non-native grassland, southern coast live oak riparian forest, southern cottonwood–willow riparian forest, southern riparian woodland, southern willow scrub, arrowweed scrub, coast live oak woodland, Engelmann oak woodland, and eucalyptus woodland. Non-native land covers include disturbed habitat, developed land, and orchard. Vegetation community distributions are also presented in Figure 2.

Table 1
Vegetation Communities

Vegetation Community/Land Cover	Acres	Percentage
Disturbed habitat*	15.7	2.56
Orchard	2.1	0.34
Diegan coastal sage scrub	162.6	26.34
Disturbed Diegan coastal sage scrub	73.6	11.92
Chamise chaparral	20.4	3.30
Diegan coastal sage scrub–southern mixed chaparral	53.5	8.67
Disturbed Diegan coastal sage scrub–southern mixed chaparral	10.5	1.70
Southern mixed chaparral	24.5	3.97
Non-native grassland	236.7	38.34
Southern coast live oak riparian forest	4.2	0.68
Southern cottonwood–willow riparian forest	0.2	0.03
Southern riparian woodland	0.4	0.06
Southern willow scrub	0.2	0.03
Arrowweed scrub	0.2	0.03
Coast live oak woodland	7.2	1.17
Engelmann oak woodland	3.2	0.52
Eucalyptus woodland	1.4	0.23
Developed	0.7	0.11
Total	617.3¹	100.00

*Assumes conversion to grassland-type fuels

¹The assessor's parcel data reports the Preserve to be 630 acres; however, calculations generated from the geographic information system data provided by the County of San Diego as shapefiles on July 20, 2009, show the Preserve as 617.3 acres. Therefore, this report references the Preserve as 617.4 acres.



Vegetation Communities:

- Annual Grassland (Non-native Grassland)
- Arrowweed Scrub
- Chamise Chaparral
- Diegan Coastal Sage Scrub
- Diegan Coastal Sage Scrub-Southern Mixed Chaparral
- Developed
- Disturbed Habitat
- Engelmann Oak Woodland
- Eucalyptus Woodland
- Coast Live Oak Woodland
- Orchard
- Oak Riparian Forest
- Southern Cottonwood-Willow Riparian Forest
- Southern Mixed Chaparral
- Southern Riparian Woodland
- Southern Willow Scrub
- disturbed Diegan Coastal Sage Scrub
- disturbed Diegan Coastal Sage Scrub-Southern Mixed Chaparral
- Simon Preserve Boundary

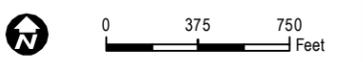


FIGURE 2
Vegetation Communities

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2.1.2 Special-Status Plant Species

Four special-status plant species were identified on the Preserve, including three species that are proposed for coverage under the North County MSCP. Table 2 presents the special-status plant species identified on the Preserve. Special status plant species locations are also presented in Figure 3.

Table 2
Special-Status Plant Species

Common Name	Scientific Name	Status*
San Diego thornmint	<i>Acanthomintha ilicifolia</i>	Federal Threatened; State Endangered; CNPS List 1B.1; County List A; NCMSCP
Orcutt's brodiaea	<i>Brodiaea orcuttii</i>	CNPS List 1B.1; County List A; NCMSCP
Engelmann oak	<i>Quercus engelmannii</i>	CNPS List 4.2; County List C; NCMSCP
Delicate clarkia	<i>Clarkia delicata</i>	CNPS List 1B.2; County List A

* CNPS = California Native Plant Society

NCMSCP = Proposed for Coverage under the Draft North County MSCP (February 2008)

2.1.3 Special-Status Animal Species

Overall, 17 special-status wildlife were observed or detected on site during surveys. Five of these are covered species under the North County MSCP. There are four reptile species; nine bird species; and four mammal species, including two small mammal species, one medium to large mammal species, and one bat species. Table 3 presents the special-status animal species observed on the Preserve. Special-status animal species locations are also presented in Figure 4.

Table 3
Special-Status Animal Species Observed on Preserve

Common Name	Scientific Name	Status* Federal/State/County
Coastal western whiptail	<i>Aspidoscelis tigris stejnegeri</i>	None/None/County Group 2
Orange-throated whiptail	<i>Aspidoscelis hyperythra</i>	None/CSC/ County Group 2, NCMSCP
Coast horned lizard	<i>Phrynosoma coronatum</i>	None/CSC/ County Group 2; NCMSCP
Coronado skink	<i>Eumeces skiltonianus interparietalis</i>	None/CSC/ County Group 2
Southern California rufous-crowned sparrow	<i>Aimophila ruficeps canescens</i>	None/State Watch List/ County Group 1; NCMSCP
Bell's sage sparrow	<i>Amphispiza belli belli</i>	Federal Birds of Conservation Concern/ State Watch List/ County Group 1; NCMSCP
Northern harrier	<i>Circus cyaneus</i>	None/CSC/ County Group 1; NCMSCP

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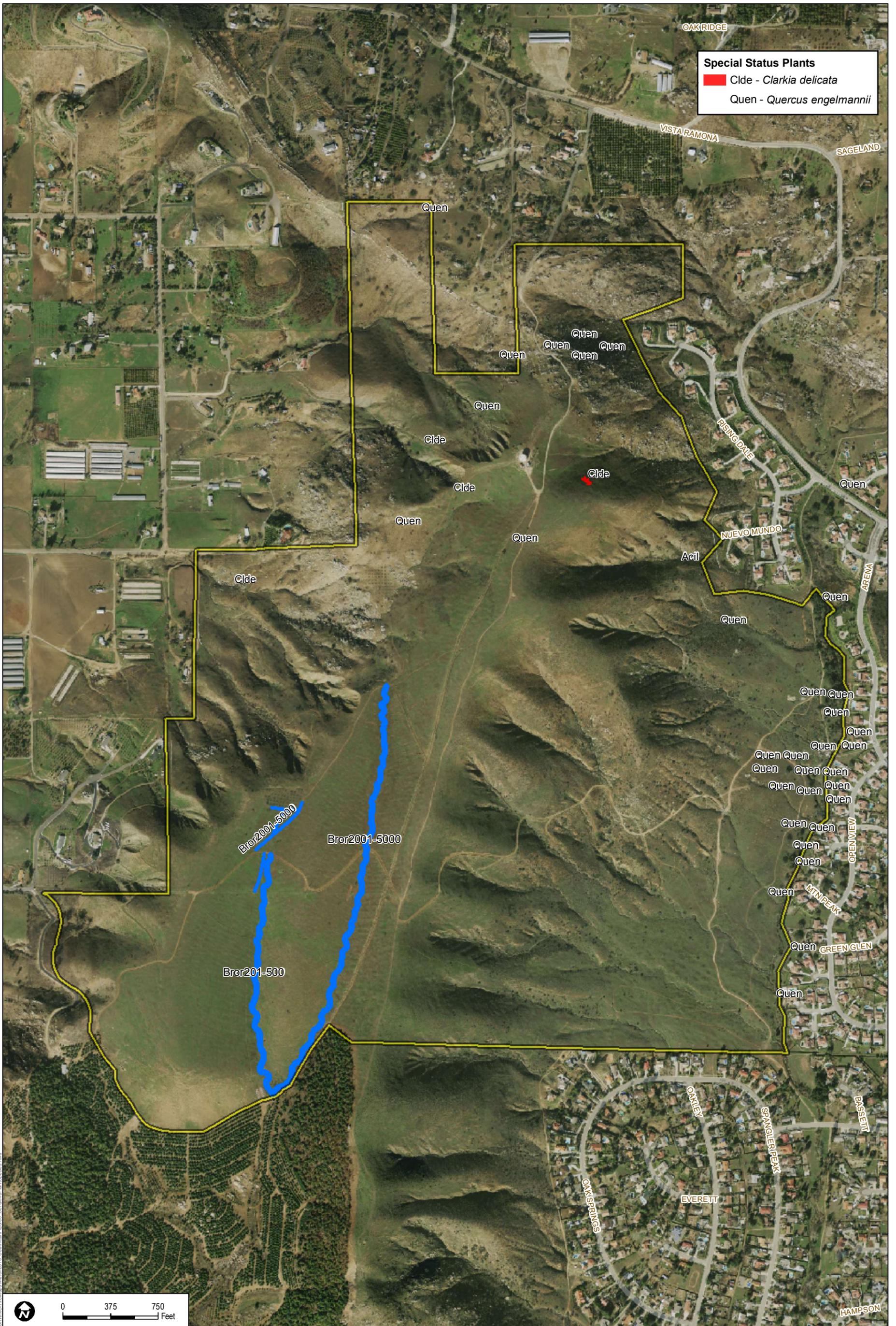
Table 3 (Continued)

Common Name	Scientific Name	Status* Federal/State/County
Loggerhead shrike	<i>Lanius ludovicianus</i>	Federal Birds of Conservation Concern/ State Watch List/ County Group 1
Barn owl	<i>Tyto alba</i>	None/None/County Group 2
California horned lark	<i>Eremophila alpestris actia</i>	None/State Watch List/ Group 2
Cooper's hawk	<i>Accipiter cooperii</i>	None/State Watch List/ County Group 1
Turkey vulture	<i>Cathartes aura</i>	None/None/County Group 1
Western bluebird	<i>Sialia mexicana</i>	None/None/County Group 2
Northwestern San Diego pocket mouse	<i>Chaetodipus fallax fallax</i>	None/CSC/ County Group 2
San Diego desert woodrat	<i>Neotoma lepida intermedia</i>	None/CSC/ County Group 2
Pocketed free-tailed bat	<i>Nyctinomops femorosaccus</i>	None/CSC/ County Group 2
Mule deer	<i>Odocoileus hemionus</i>	None/None/County Group 2

* CSC = California Special Concern Species

NCMSCP = Proposed for Coverage under the Draft North County MSCP (February 2008)

Special-status reptile species were observed at the Preserve during herpetological surveys: coastal western whiptail (*Aspidoscelis tigris stejnegeri*), orange-throated whiptail (*Aspidoscelis hyperythra*), coast horned lizard (*Phrynosoma coronatum*), and Coronado skink (*Eumeces skiltonianus interparietalis*). These species may be affected by fire as a result of direct mortality if they cannot outrun the fire, or by loss of habitat; however, since they are fossorial for at least portions of their life cycle, they may be affected less by the temporal loss of vegetative cover than other wildlife species.



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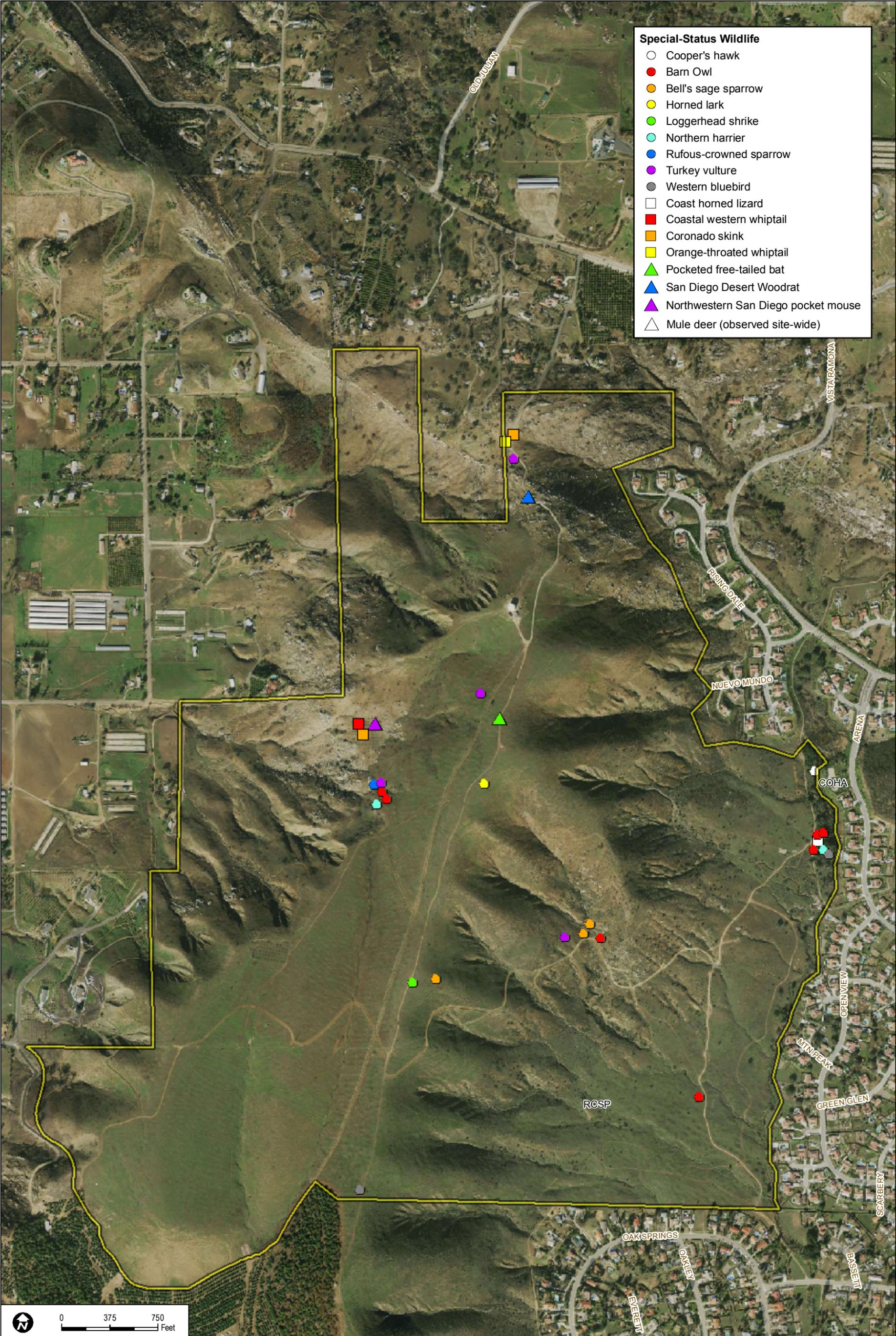
SOURCE: Preserve Boundary, County of San Diego;
Dudek 2010; DigitalGlobe 2008

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FIGURE 3

Special-Status Plant Species

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- Special-Status Wildlife**
- Cooper's hawk
 - Barn Owl
 - Bell's sage sparrow
 - Horned lark
 - Loggerhead shrike
 - Northern harrier
 - Rufous-crowned sparrow
 - Turkey vulture
 - Western bluebird
 - Coast horned lizard
 - Coastal western whiptail
 - Coronado skink
 - Orange-throated whiptail
 - ▲ Pocketed free-tailed bat
 - ▲ San Diego Desert Woodrat
 - ▲ Northwestern San Diego pocket mouse
 - △ Mule deer (observed site-wide)



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SOURCE: Preserve Boundary, County of San Diego;
Dudek 2010; DigitalGlobe 2008

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FIGURE 4
Special-Status Animal Species

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Although most bird species may leave an area that has recently burned, some birds are opportunistic and take advantage of resources that become available after a fire: for example, woodpeckers use newly made cavities in burned snags. Other bird populations are generally known to decline as an immediate response to wildfires as a result of movement to unburned patches and also from direct fatalities as result of overexposure to the fire. During the 1996 Elfin Forest Fire, Dudek biologists noted several birds that were observed killed directly. The Preserve has been documented as being affected by fire in the recent past. The California gnatcatcher (*Polioptila californica*) was originally documented on site but has not been recorded in the recent survey efforts. This may be due to the habitat changes that occurred immediately after the 2003 Cedar Fire. Other species may recolonize more quickly. A number of special-status bird species have been recorded on the Preserve: Southern California rufous-crowned sparrow (*Aimophila ruficeps canescens*), Bell's sage sparrow (*Amphispiza belli belli*), northern harrier (*Circus cyaneus*), loggerhead shrike (*Lanius ludovicianus*), barn owl (*Tyto alba*), California horned lark (*Eremophila alpestris actia*), Cooper's hawk (*Accipiter cooperii*), turkey vulture (*Cathartes aura*), and western bluebird (*Sialia mexicana*). Many of these are grassland species that will take advantage of the recovering habitat for foraging.

The degree to which mammals are successful at surviving wildfire depends on the animal's mobility and size and the uniformity, severity, size, and duration of the fire. Small mammals usually attempt to escape wildfire by using subterranean shelters similar to reptiles. Small rodents, such as woodrats, that construct surface dwellings are particularly vulnerable and will lose their home, shelter, and forage in a fire. More mobile, large mammals such as carnivores and ungulates may be able to outrun most fires but then must find refuge in unburned patches or along the periphery of the fire. Large mammal death is generally rare but possible when fronts are fast moving, wide, and actively crowning with thick ground smoke, as was noted in the Elfin Forest Fire that occurred in 1996 (Dudek pers. comm.).

Special-status mammal species that have been documented on the site and that may be affected by fires include northwestern San Diego pocket mouse (*Chaetodipus fallax fallax*), San Diego desert woodrat (*Neotoma lepida intermedia*), and mule deer (*Odocoileus hemionus*). Of these species, the pocket mouse and woodrat are most at risk of both direct and indirect impact of fire.

2.2 Cultural Resources

Sixteen cultural resources have been recorded within the Simon Preserve according to the Preserve's Archaeological Survey Report (ASM Affiliates, Inc. 2010). These consist of eleven previously recorded sites, four newly recorded sites, and one newly recorded isolate (Table 4). Six of the sites are prehistoric, five are historic, and four contain both prehistoric and historic components; the one isolate is historic. Site locations are depicted in Figure 14, "Cultural

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resources within Simon Preserve shown on aerial photograph,” of the Confidential Archaeological Survey Report for the Simon Preserve (Appendix B).

Table 4
Sensitive Cultural Resources Within the Preserve

Site Number	Era	Site Contents	Eligibility Status
<i>New Sites</i>			
SDI-19640	Historic	Historic Trash Scatter	Significant under County Guidelines
SDI-19641	Historic	Historic Trash Scatter	Significant under County Guidelines
SDI-19642	Historic	Historic road bed and rock alignment	Significant under County Guidelines
SDI-19643	Historic	Historic Prospecting Pits	Significant under County Guidelines
<i>New Isolate</i>			
CW-I-1	Historic	Automobile	Ineligible for CRHR
<i>Previously Recorded Sites</i>			
SDI-5038	Prehistoric and Historic	Bedrock Milling, Lithic Scatter; Metal Fragments	Loci A-D: Eligible for CRHR Loci E-F Ineligible for CRHR Historic: Ineligible for CRHR
SDI-5040	Prehistoric and Historic	Bedrock Milling, Lithic Scatter, Ceramic Scatter; Olive Grove, Historic Trash Scatter	Prehistoric: Ineligible for CRHR Historic: Significant under County Guidelines
SDI-11637	Prehistoric	Lithic Scatter	Ineligible for CRHR
SDI-11638	Prehistoric and Historic	Lithic Scatter; Orchard	Ineligible for CRHR
SDI-11639	Prehistoric	Lithic Scatter	Ineligible for CRHR
SDI-11640	Prehistoric	Lithic Scatter	Ineligible for CRHR
SDI-11641	Prehistoric	Lithic Scatter	Ineligible for CRHR
SDI-11642	Prehistoric	Lithic Scatter	Locus A: Eligible for CRHR Locus B: Ineligible for CRHR
SDI-11643/H (including SDI-11653)	Prehistoric and Historic	Bedrock Milling, Lithic Scatter; Historic Habitation, Historic Trash Scatter	Historic: Eligible for CRHR Prehistoric: Eligible for CRHR
SDI-11644	Prehistoric	Lithic Scatter	Ineligible for CRHR
SDI-11650	Historic	Historic Well	Ineligible for CRHR

CRHR - California Register of Historic Resources

3.0 INVASIVE SPECIES MANAGEMENT

Protecting native plant species and the habitats in which they occur is one objective of the Preserve. Many invasive non-native plants have been introduced to the Preserve either through escape from adjacent landscapes or opportunistically from bird-dropped seed or other natural seed dispersal methods. Most of the invasive non-native species establishing on the Preserve have had no or minimal deleterious effects on the Preserve’s natural habitat. However, some invasive non-native plants exhibit an aggressive growth habit and can out-compete and displace

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native species. As such, these invasive non-native plants can have significant impacts on insect–native plant associations, ecosystem processes, and biodiversity, as discussed in Section 3.1.

3.1 Target Invasive Species

Based on the baseline inventory conducted in 2010 (Dudek 2010), five invasive plant species were observed, as identified in the California Invasive Plant Council (Cal-IPC) Inventory (Cal-IPC 2006) (Figure 5). These species were generally observed in low numbers and are not anticipated to result in reduction of habitat quality. However these species were noted as follows:

- Tamarisk (*Tamarix* spp.) occurs as five individuals on the Preserve. Tamarisk presents the greatest risk of reducing habitat quality. Although some riparian birds will use tamarisk for foraging, in general, sensitive riparian birds do not include tamarisk as a preferred habitat component. This species would be a priority for removal. Because tamarisk is a sizable plant, it can be well controlled by mechanical methods. Limited chemical methods may be required after the initial mechanical removal. As noted in the NCMSCP Framework Resource Management Plan [FRMP] (County of San Diego 2009b), removed invasive plants should be properly disposed of to off-site facilities. The area from which tamarisk would be removed is potentially appropriate for replanting with other riparian plant species.
- Eucalyptus trees (*Eucalyptus* spp.) are present as several individuals within the Preserve. Eucalyptus trees on site present a lower risk of reducing habitat quality than tamarisk, but should still be considered a removal priority. As such, the best treatment for eucalyptus removal is through mechanical and herbicidal treatments. Eucalyptus trees may be cut and sprayed with the appropriate herbicide, or trees may be removed with the use of girdling and herbicidal treatment. Trees can be girdled past the xylem/phloem and treated with an appropriate herbicide. Follow-up herbicidal treatment may be necessary, as sucker growth may occur.
- Canary Island date palm (*Phoenix canariensis*) occurs as three individuals within the Preserve. Control of Canary Island date palm will include a combination of both mechanical and herbicidal means. A large wedge may be cut from the trunk of the trees, and the appropriate systemic herbicide may be applied. Caution should be taken when this treatment occurs, as trees may fall and cause damage if they are left standing.
- Peruvian pepper tree (*Schinus molle*) occurs as one individual on the Preserve. Peruvian pepper trees on site present a lower risk of reducing habitat quality than tamarisk, but should still be considered a removal priority. As such, the best treatment for pepper removal is through mechanical and herbicidal treatments. Pepper trees may be cut and

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sprayed with the appropriate herbicide, or trees may be removed with the use of girdling and herbicidal treatment. Trees can be girdled past the xylem/phloem and treated with an appropriate herbicide. Follow up herbicidal treatment may be necessary, as sucker growth may occur.

- Mexican fan palm (*Washingtonia robusta*) occurs as one individual on the Preserve. Control of Mexican fan palm will include a combination of both mechanical and herbicidal means. A large wedge may be cut from the trunk of the trees, and the appropriate systemic herbicide may be applied. Caution should be taken when this treatment occurs, as trees may fall and cause damage if they are killed and left standing.
- Bailey acacia (*Acacia baileyana*) occurs as two individuals on the Preserve. Acacia trees on site present a lower risk of reducing habitat quality than tamarisk, but should still be considered a removal priority. As such, the best treatment for acacia removal is through mechanical and herbicidal treatments. Acacia trees may be cut and sprayed with the appropriate herbicide, or trees may be removed with the use of girdling and herbicidal treatment. Trees can be girdled past the xylem/phloem and treated with an appropriate herbicide. Follow up herbicidal treatment may be necessary, as sucker growth may occur.
- Non-native grasses dominate much of the site and include slender wild oat (*Avena fatua*) and bromes (*Bromus* spp.). Non-native forbs, also found in non-native grasslands, include filaree (*Erodium* spp.) and mustards (*Brassica nigra*, *Hirschfeldia incana*). Depending on the soils and their ability to grow shrub species and the goals for habitat cover, non-native grasses can be converted to other native vegetation types over time. Control of these species may include cutting, herbicides, grazing, prescribed fire, and revegetation, and would ideally include a combination of these measures (County of San Diego 2009a). Preventing the long-term conversion of vegetation communities to annual grassland may require managing fire return interval to allow sufficient time for habitat succession from annual grasslands to native shrub-dominated communities. Frequent burns at short intervals can drive the permanent conversion of shrub-dominated communities to grass-dominated communities.

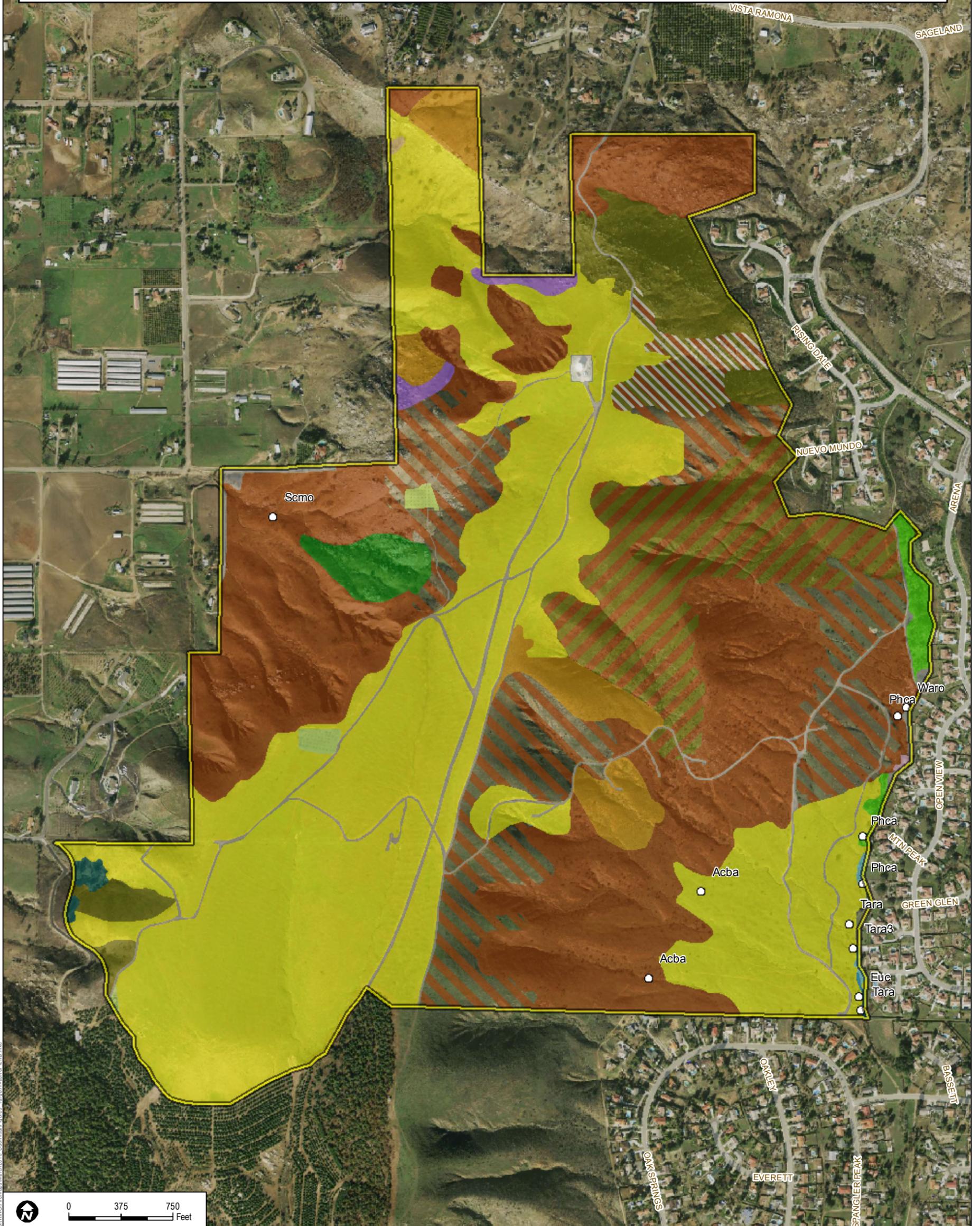
Invasive Plant Locations

- Acba - *Acacia baileyana*
- Phca - *Phoenix canariensis*
- Euc - *Eucalyptus* spp.
- Waro - *Washingtonia robusta*
- Scmo - *Schinus molle*
- Tara - *Tamarix ramosissima*

Vegetation Communities:

- Annual Grassland (Non-native Grassland)
- Arrowhead Scrub
- Chamise Chaparral
- Diegan Coastal Sage Scrub
- Diegan Coastal Sage Scrub-Southern Mixed Chaparral
- Developed
- Disturbed Habitat
- Engelmann Oak Woodland
- Eucalyptus Woodland

- Coast Live Oak Woodland
- Orchard
- Oak Riparian Forest
- Southern Cottonwood-Willow Riparian Forest
- Southern Mixed Chaparral
- Southern Riparian Woodland
- Southern Willow Scrub
- disturbed Diegan Coastal Sage Scrub
- disturbed Diegan Coastal Sage Scrub-Southern Mixed Chaparral



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3.2 Removal Methods

3.2.1 Herbicides

The application of herbicide to control target invasive tree species on the Preserve will be limited to secondary treatments following manual or mechanical removal, for the purposes of controlling sprout growth and regeneration. Herbicide application is recommended following removal of all target invasive tree species, including tamarisk, eucalyptus, Peruvian pepper, Canary Island date palm, and Mexican fan palm. Herbicide use for controlling non-native grasses and forbs will be focused in areas of native plant species, especially the sensitive plants such as Orcutt's brodiaea (*Brodiaea orcuttii*) and areas with clay soils (within the southeastern corner of the site along the drainage) where the non-native grasses may compete with the native species. There are a wide range of available herbicides for such types of treatment. Herbicide labels and material safety data sheets list susceptible target plant species and provide proper direction in the use and handling of the products.

3.2.2 Manual Removal

Manual vegetation removal may occur for controlling non-native grasses and forbs within a focused area of native plant species. Manual removal should be incorporated where herbicide application is ineffective or sensitive plant species proximity prevents safe application (e.g., drifting of herbicides). Grasses and forbs should be disposed of off site.

3.2.3 Mechanical Removal

Mechanical removal will be necessary for control of the target invasive tree species on the Preserve and will be combined with herbicide application. Cutting and removal of the aboveground plant material will be conducted via the use of chainsaws, hand saws, or both, and the resulting material will be chipped and hauled off site. Subsequent application of herbicides shall follow product guidelines for safe transport, storage, and application. Stumps remaining on site after cutting and herbicide application are not recommended for removal or grinding but should be left to decompose on site.

3.2.4 Cut and Daub

Cut and daub treatment is not currently recommended on the Preserve given the specific target invasive species present.

4.0 HABITAT RESTORATION

As stated in the North County MSCP Framework Resource Management Plan (FRMP) (County of San Diego 2009b), the goal of habitat restoration is to reestablish or enhance the biological functions and values of habitat that have been degraded from either human or natural causes.

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Restoration methods range from active revegetation, which recreates habitat, to passive management. For preserve lands, restoration is typically not required; however, if resources are available, restoration may assist the recovery of an area that has been disturbed and is showing difficulty in recovering.

The Preserve is generally composed of high-quality habitat, and even the non-native grassland areas serve important functions for foraging for raptors. However, due to the recent wildfires, some of the sage and chaparral habitat areas appear to be slow with recovery. This may especially be due to the low rainfall years. These areas will require continued monitoring to gauge the necessity of intervention.

4.1 Proposed Restoration Areas

Restoration opportunities for the Preserve include restoration of areas that would provide habitat for sensitive species that inhabit the Preserve, such as disturbed Diegan coastal sage scrub and disturbed Diegan coastal sage scrub–southern mixed chaparral, as well as restoring oak woodlands (especially Engelmann oak woodlands) if they appear to decline based on the monitoring studies conducted in accordance with the North County MSCP FRMP. Potential restoration sites are presented in Figure 6. At present, no imminent restoration projects are identified. Future monitoring visits will focus on the need for restoration activities. Should a wildfire or other disturbance occur within the Preserve, the need for restoration will be reevaluated and restoration areas prioritized, as necessary.

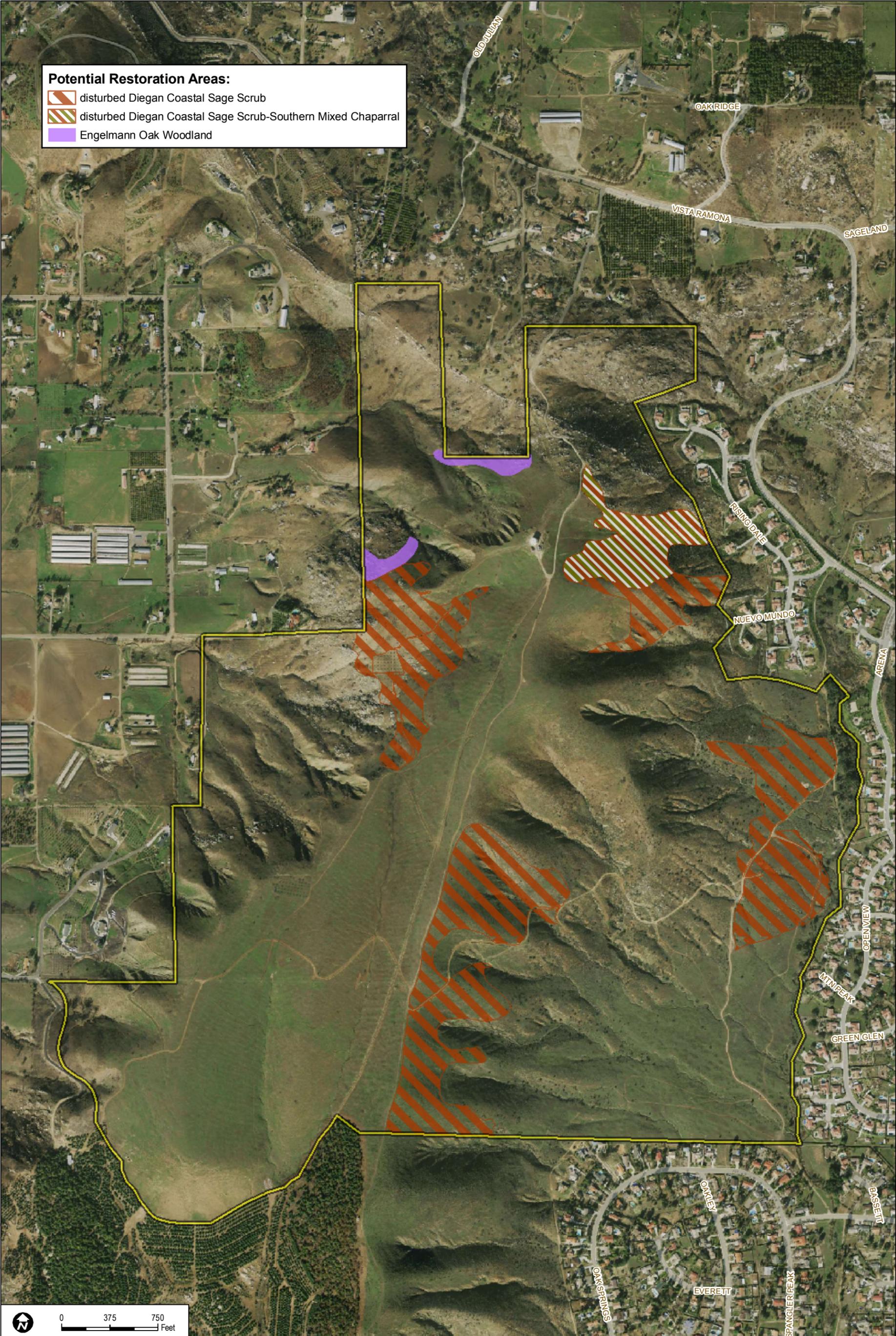
4.2 Restoration Methods

Currently, no active restoration efforts are recommended for the Preserve. Recent wildfires on site have altered habitat structures, which will be monitored in accordance with the FRMP. However, methods are described below should restoration efforts be deemed necessary.

4.2.1 Diegan Coastal Sage Scrub

Restoration of Diegan coastal sage scrub would focus on weed and invasive species control using integrated pest management techniques. The impetus shall be on the timely control of weeds and exotics to prevent and minimize further production and distribution of weed seed/propagules. Weed control activities shall be scheduled to take place prior to seed maturation and dispersal. Thatch build-up from weeds and annual grasses will be either removed or integrated into the soil before the application of native seeds. Slash from exotic species will be containerized and removed from site.

Following weed control and thatch removal activities, the site will be seeded with the appropriate native seed mix during the appropriate time of the year. A qualified biologist will make site-specific recommendations for seed species, composition, application rate, and timing and methods of seed application.



Potential Restoration Areas:

-  disturbed Diegan Coastal Sage Scrub
-  disturbed Diegan Coastal Sage Scrub-Southern Mixed Chaparral
-  Engelmann Oak Woodland



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SOURCE: Preserve Boundary, County of San Diego;
Dudek 2010; DigitalGlobe 2008

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FIGURE 6
Habitat Restoration Sites

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In general, passive restoration that focuses on weed control and seedling/recruitment establishment will be utilized to restore disturbed areas. A qualified and experienced restoration contractor with a valid contractor's license class C-27 shall perform, and a qualified biologist shall monitor, restoration work.

4.2.2 Engelmann Oak Woodland

In the event oak woodlands (especially Engelmann oak woodlands) are declining on the Preserve, as determined through monitoring surveys conducted in accordance with the North County MSCP FRMP, planting Engelmann oak trees is recommended.

Oak trees shall be planted in the fall and provided with sufficient irrigation to allow them to become established. All irrigation shall cease within 3 years of planting, and trees shall be allowed to become naturalized. Immediately upon planting, oak trees should be protected from deer and rabbits using tree protection devices (i.e., physical barriers). If gophers are present, a root cage shall be installed around the tree rootballs.

Oak tree restoration sites shall be planted with Engelmann oak trees from a mixture of pine cells, leach tubes, super cells, deep 1-gallon, and/or 1- and 5-gallon plant materials, as the project biologist deems appropriate for each site. The planting holes shall be the depth of the rootball. The backfill mix shall be based on soil test results, in consultation with the project biologist. Each oak tree should have a basin four times the diameter of the rootball. The basin shall have berms that measure 6 inches high to hold irrigation and rain water. The basins shall have a 4-inch-deep mulch layer with mulch held back 2 inches from the tree trunks. Basin mulch will help keep the roots cool, conserve water, and suppress weeds. A 5-foot-diameter weed-free band shall be kept around all container-planted oak trees. A 5-inch-deep organic mulch layer may be used to suppress weed growth around oak trees.

Once the trees are 5 to 6 feet tall, the protective cages shall be removed.

If deemed necessary by the project biologist, the oak tree restoration site shall be cleared of weeds and seeded with the appropriate native seed mix during the appropriate time of the year. The biologist will make site-specific recommendations for seed species, composition, application rate, and timing and methods of seed application.

A qualified and experienced restoration landscape contractor with a valid contractor's license class C-27 shall perform, and a qualified biologist shall monitor, restoration work.

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5.0 FIRE MANAGEMENT

5.1 Current Fire Management Practices

Currently, fire management practices on the Preserve are restricted to response and tactical suppression efforts associated with wildfires originating on or burning onto the Preserve. No active fire or fuels management plans are currently employed on the Preserve.

5.2 Fire Environment

Fire environments are dynamic systems and include many types of environmental factors. Fires can occur in any environment where conditions are conducive to ignition and fire movement. Natural open space areas like the Preserve are typically comprised of conditions favorable to wildfire spread. The three major components of fire environment are climate, topography, and vegetation/fuels. The state of each of these components and their interaction with each other determine the potential characteristics and behavior of a fire at any given moment. Understanding these existing conditions is necessary to understand the potential for fire within and around the Preserve.

5.2.1 Climate

As with most of Southern California, the Preserve area is influenced by the Pacific Ocean and is frequently under the influence of a seasonal, migratory, subtropical high-pressure cell known as the Pacific High. Wetter winters and dry summers, with mild seasonal changes, generally characterize the Southern California climate. This climate pattern is occasionally interrupted by extreme periods of hot weather, winter storms, or dry, easterly Santa Ana winds.

In order to evaluate specific weather variables for the Preserve, data from the Goose Valley Remote Automated Weather Station (RAWS) was analyzed (RAWS 2009). The Goose Valley RAWS is the closest weather station, located approximately 3 miles north of the Preserve. As of the date of this report, no RAWS is located on the Preserve property. The following summarizes the location and available data range for the Goose Valley station:

- Latitude: 33.07361
- Longitude: -116.84583
- Elevation: 1,530 feet
- Data years: 1981 to 2008.

There is some local variance to the typical Southern California climate, however; the inland location of the Preserve affects the degree of influence of the Pacific Ocean, resulting in less-

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regulated temperatures. The average high temperature for this area is approximately 87.7° Fahrenheit (F), with higher temperatures in summer and early fall (July through October) reaching up to 112°F (RAWS 2009). The mean precipitation for the area is 11.7 inches per year, with the majority of rainfall concentrated in the months of December (1.86 inches), January (2.35 inches), February (3.19 inches), and March (1.76 inches) (RAWS 2009).

The prevailing wind pattern is from the west, but the presence of the Pacific Ocean causes a diurnal wind pattern known as the land/sea breeze system. During the day, winds are typically from the west–southwest (sea); at night, winds are from the northeast (land).x The diurnal winds can be slightly stronger during the summer season than during the winter season due to greater pressure-gradient forces. Surface winds can also be influenced locally by topography and slope variations. The varied topography on the Preserve may affect wind velocity and patterns. The highest wind velocities are typically associated with downslope, canyon, and Santa Ana winds.

The fire season in Southern California typically starts in June, as vegetation begins to dry out after winter and spring rains, and typically ends in October, although fire weather may be present year round (Schroeder and Buck 1970). The highest fire danger for this area coincides with the Santa Ana winds. Santa Ana wind conditions are a reversal of the prevailing southwesterly winds that usually occur on a region-wide basis during late summer and early fall. Santa Ana winds are dry, warm winds that flow from the higher desert elevations in the north through the mountain passes and canyons. As they converge through the canyons, their velocities increase. Consequently, peak velocities are highest at the mouths of canyons and dissipate as they spread across valley floors.

Utilizing the FireFamily Plus v. 4.0.0 (FireFamily Plus 2007) software package, data from the Goose Valley RAWS was processed and analyzed to determine general weather conditions for the region (Table 5). In addition, RAWS data was analyzed to determine extreme fire weather conditions, specifically 97th percentile wind and fuel moisture conditions to be used in the fire behavior modeling efforts conducted for the Preserve. The fire weather variables and an analysis of fire behavior for the Preserve are presented in Section 5.2.5 and Appendix C.

Table 5
Weather Conditions for the Preserve

Season	Wind Speed (mph)		Air Temperature (°F)			Relative Humidity (%)			Average Monthly Precipitation (in)
	Avg.	Max.	Avg.	Max.	Min.	Avg.	Max.	Min.	
Summer (6/21–9/21)	7.4	26.0	72	112	32	62	100	19	0.1
Fall (9/22–12/20)	6.4	25.0	62	106	32	57	100	1	0.9
Winter (12/21–3/19)	5.5	60.0	54	100	20	61	100	1	2.8
Spring (3/20–6/20)	6.6	24.0	61	106	28	66	100	4	0.7

mph = miles per hour

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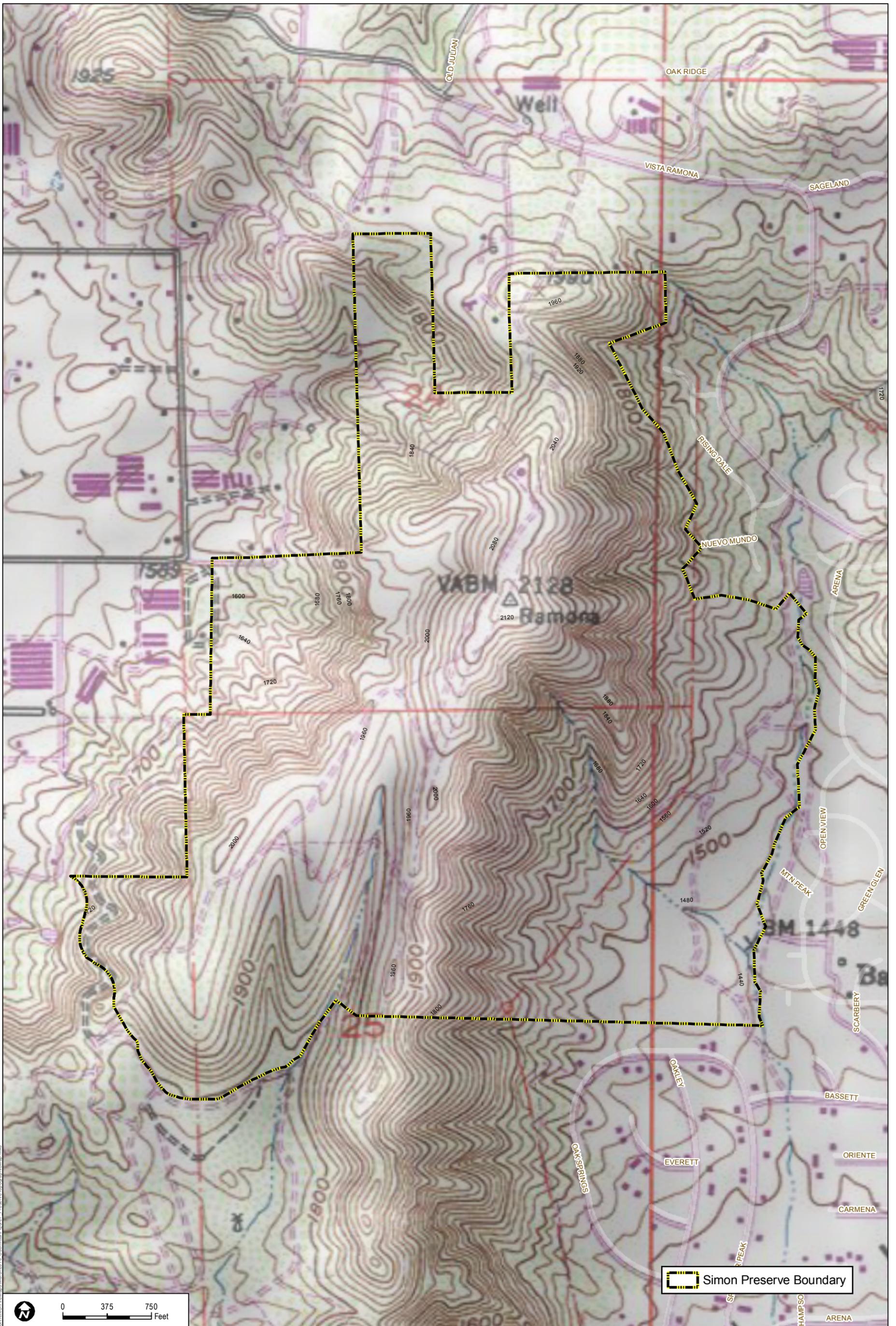
5.2.2 Topography

The topography of the Preserve is influenced primarily by the intersection of two ridgelines in the central portion of the property. Both ridgelines are generally north–south trending and bisect the property. On-site elevation ranges from 1,440 feet above mean sea level in the southeast corner of the property to a maximum of 2,120 feet above mean sea level at the intersection of both ridgelines. East-facing slopes characterize the eastern portion of the Preserve, while west- and northwest-facing slopes characterize the western portion. Slope gradients in both areas reach up to 35%. The sloped regions on both the east and west sides of the Preserve are also characterized by a series of smaller sub-drainages, gullies, and draws that flow downward away from the prominent ridgelines. Site topography is graphically presented in the map in Figure 7.

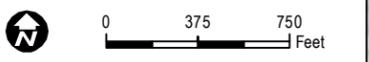
5.2.3 Watershed Description

The primary ridgelines bisecting the Preserve effectively divide the drainage patterns toward San Vicente Creek in the eastern and southern portions of the Preserve and toward the Santa Maria Valley, and subsequently the Santa Maria Creek, in the western portion of the Preserve. The western portion of the Preserve generally drains to the northwest via small sub-drainages, gullies, and draws towards adjacent rural residential areas within the eastern portion of the community of Ramona. Santa Maria Creek is the nearest named receiving water body and is located approximately 2.5 miles to the northwest of the Preserve. Santa Maria Creek is tributary to the San Pasqual River, located approximately 10 miles to the northwest of the Preserve.

The southern and eastern portions of the Preserve generally drain to the southeast into a natural, on-site stream channel that flows north–south along the eastern boundary of the Preserve. The drainage is an unnamed tributary to San Vicente Creek, located approximately 0.8 mile south of the Preserve along the south side of San Vicente Road. San Vicente Creek drains into the San Vicente Reservoir before continuing in a generally southwest direction towards its confluence with the San Diego River near the community of Lakeside. Designated beneficial uses for the Santa Maria Creek in the San Dieguito watershed include municipal and domestic supply, agricultural supply, industrial service supply, industrial process supply, contact and non-contact water recreation, warm freshwater habitat, and wildlife habitat. Designated beneficial uses for the San Diego River and its tributaries consist of all of these uses as well as cold freshwater habitat and rare, threatened, or endangered species habitat (California Regional Water Quality Control Board 1994).



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DUDEK

SOURCE: DigitalGlobe 2008; SanGIS 2007; USGS Digital Raster Graphic - Ramona Quadrangle

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Simon Preserve Boundary

FIGURE 7
Preserve Topographic Map

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5.2.4 Fire History

Fire history is an important component in understanding fire frequency, fire type, significant ignition sources, and vulnerable areas. The topography, vegetation, and climatic condition associated with the Preserve combine to create a unique situation capable of supporting large-scale, high-intensity wildfires. The history of wildfires on the Preserve is graphically portrayed in Figure 8.

Based on historical fire perimeter data from Cal Fire’s Fire and Resource Assessment Program (FRAP 2009)¹, the entire Preserve has burned at least once during the recorded data period, with the vast majority of the site having burned more than three times between 1928 and 2007. Table 6 presents the quantity of times the Preserve has burned, by land area (acreage).

Table 6
Quantity of Times Preserve has Burned

Quantity of Times Burned*	Acreage	Percentage
1	0.1	0.0
2	41.5	6.7
3	314.3	50.9
4	192.0	31.1
5	69.5	11.3
Total	617.4	100.0

*FRAP 2009

Based on an analysis of this fire history data set, specifically the years in which the fires burned, the average interval between wildfires on the Preserve was calculated to be 15.8 years, with intervals ranging between 3 and 25 years. However, this average includes two short intervals of 3 and 4 years, so an evaluation of the median interval between fires is calculated at 23 years. Based on this analysis, it is expected that the Preserve would be subject to wildfire occurrence every 23 years, with the realistic possibility of short interval occurrences. Table 7 presents the fire interval data for the Preserve.

¹ Based on polygon GIS data from FRAP, which includes data from Cal Fire, U.S. Department of Agriculture Forest Service Region 5, Bureau of Land Management, CNPS, contract counties, and other agencies. The data set is a comprehensive fire perimeter GIS layer for public and private lands throughout the state and covers fires of 10 acres and greater size back to 1878.

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Table 7
Fire Intervals for the Preserve

Fire Year*	Fire Name	Interval (years)	Acreage Burned on Preserve	Percent of Preserve Burned**
1928	Unnamed	n/a	608.3	98.6
1953	Vicente Fire	25	9.3	1.5
1956	Outside Origin No. 42	3	11.5	1.9
1979	Hanson Fire	23	554.9	89.9
2003	Cedar Fire	24	568.7	92.1
2007	Witch Fire	4	388.3	62.9

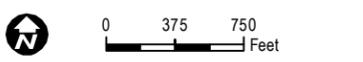
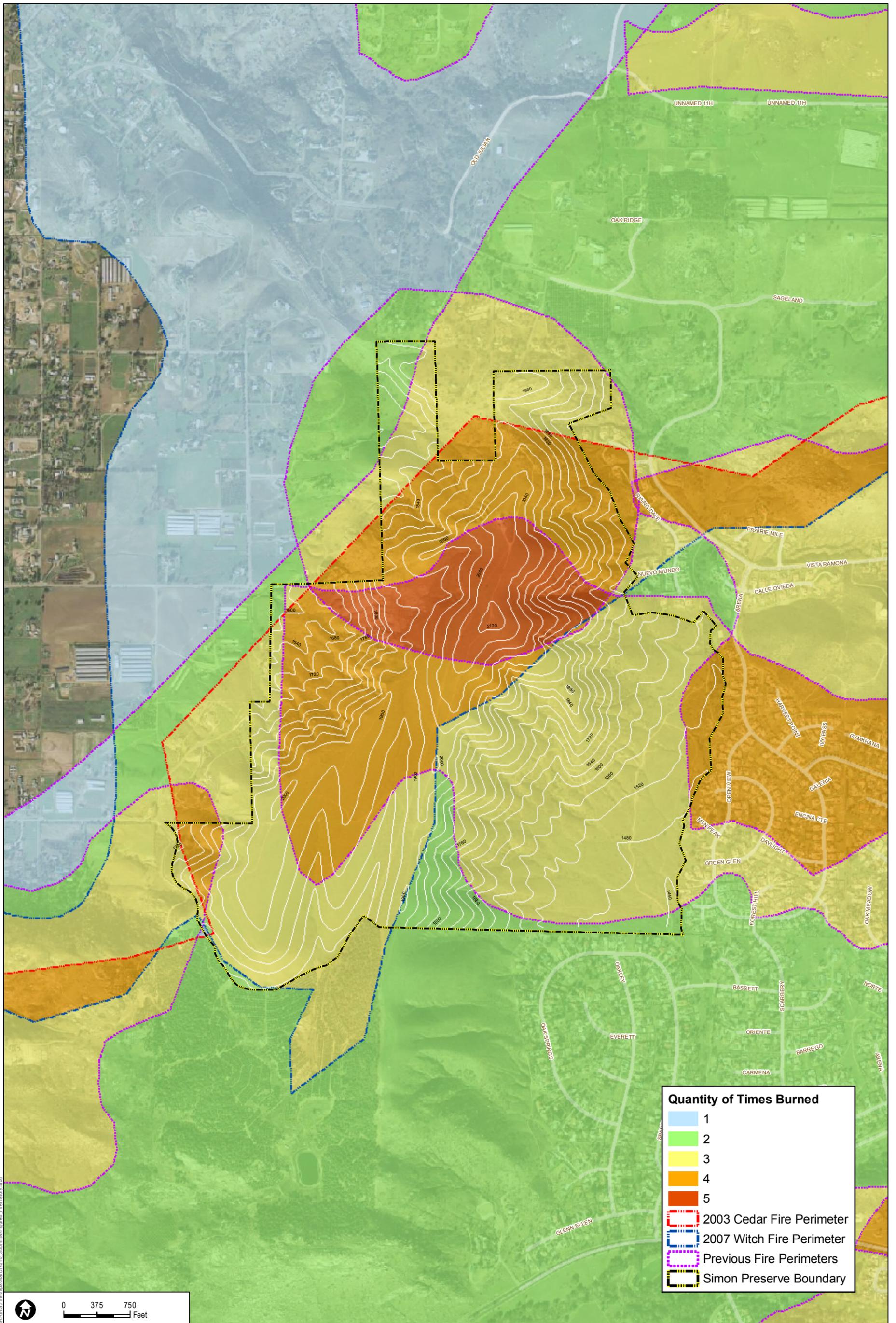
*FRAP 2009

**Based on total Preserve acreage of 617.4

Finally, fire history is a useful data set from which to determine vegetation age classes for the Preserve. Based on an analysis of the fire history, the entire site has burned within the past 6 years, either in the 2003 Cedar Fire or the 2007 Witch Fire. Accordingly, vegetation age on site is either 2 years old (388.5 acres (62.9%)), resulting from the 2007 Witch Fire, or 6 years old (228.7 acres (37.1%)), resulting from the 2003 Cedar Fire. Based on these ages, the vegetation is considered young and less susceptible to fire than older vegetation, but still capable of igniting and carrying fire, especially during extreme weather (i.e., Red Flag Warning conditions).

5.2.5 Vegetation Dynamics and Fuel Loads

Dudek (2009) conducted vegetation mapping, which resulted in a total of eighteen vegetation communities and land covers on site (Table 1). Once field mapping was completed, vegetation polygons were digitized using ArcGIS software. The resulting vegetation community acreages were calculated with the use of GIS. Vegetation distribution throughout the Preserve varies by location and topography. Riparian trees and scrub are concentrated in canyon bottoms and low, flatter areas, while upland areas typically support shrub cover (either Diegan sage scrub or chaparral) or grass cover. The dominant land cover for the Preserve is grassland (38%), with significant areas covered by Diegan sage scrub (26%). Grasslands are distributed primarily in the center of the site, stretching from the northeast to southwest corner, while also occurring in the southeastern corner of the Preserve.



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Utilizing site vegetation maps, field evaluations were conducted to evaluate fuel loading and classify vegetation types into fuel models (Anderson 1982, Scott and Burgan 2005, Weise and Regelbrugge 1997). Fuel model assignments are presented by vegetation type in Table 8 and are graphically presented in Figure 9. Certain vegetation types increase fire hazard based on plant physiology (e.g., resin content), biological function (e.g., flowering, retention of dead plant material), and/or physical structure (e.g., leaf size, branching patterns). For example, chaparral and sage scrub species found in portions of the Preserve are considered to exhibit higher potential hazard based on such criteria, including the following species: coastal sagebrush (*Artemisia californica*), chamise (*Adenostoma fasciculatum*), California buckwheat (*Eriogonum fasciculatum*), and black sage (*Salvia mellifera*). Non-native invasive species presenting similar attributes include mustard (*Brassica* spp.), thistle, tobacco (*Nicotiana* spp.), and juniper (*Juniperus* spp.). These vegetation types present additional hazard when located adjacent to neighboring structures or within defensible space zones. The importance of vegetation and species types on fire suppression efforts is their role in affecting fire behavior. For example, while fires burning in grasslands may exhibit lower flame lengths than those burning in chaparral or sage scrub, fire spread rates in grasslands are often much more rapid than those in other vegetation types.

Table 8
Vegetation Communities and Associated Fuel Models

Vegetation Community/Land Cover	Fuel Model	Acres	Percentage
Disturbed habitat	1*	15.7	2.56
Orchard	9	2.1	0.34
Diegan coastal sage scrub	SCAL18	162.6	26.34
Disturbed Diegan coastal sage scrub	SCAL18	73.6	11.92
Chamise chaparral	SH7	20.4	3.30
Diegan Coastal sage scrub–southern mixed chaparral	SH7	53.5	8.67
Disturbed Diegan coastal sage scrub–southern mixed chaparral	SH7	10.5	1.70
Southern mixed chaparral	SH7	24.5	3.97
Non-native grassland	1	236.7	38.34
Southern coast live oak riparian forest	8	4.2	0.68
Southern cottonwood–willow riparian forest	8	0.2	0.03
Southern riparian woodland	8	0.4	0.06
Southern willow scrub	8	0.2	0.03
Arrowweed scrub	SCAL18	0.2	0.03
Coast live oak woodland	9	7.2	1.17
Open Engelmann oak woodland	9	3.2	0.52
Eucalyptus woodland	TU5	1.4	0.23
Developed	0	0.7	0.11
	Total	617.3	100.00

*Assumes conversion to grassland-type fuels

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Vegetation Dynamics

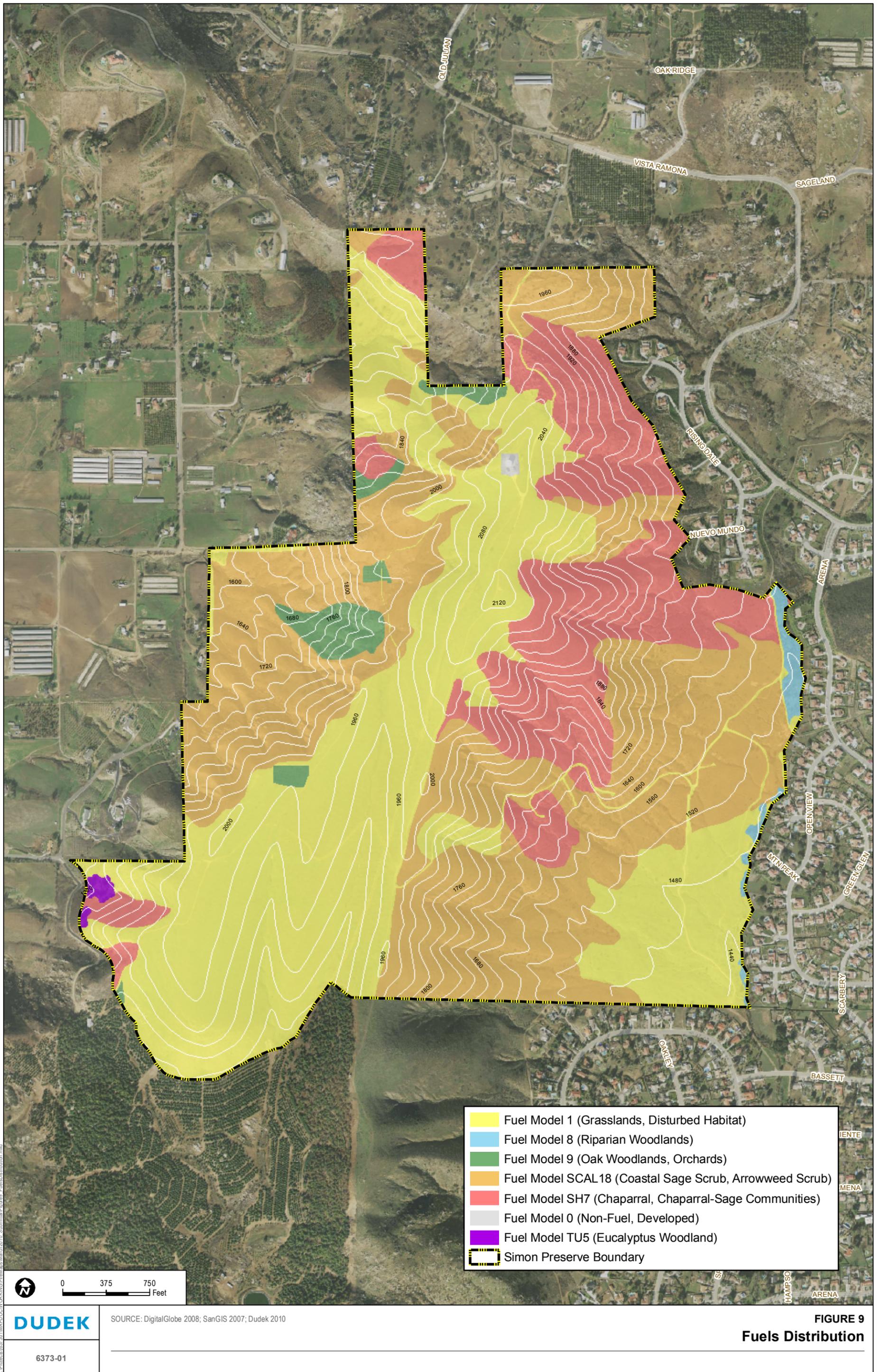
Vegetation plays a significant role in fire behavior and is an important component of the fire behavior models discussed in this section. A critical factor to consider is the dynamic nature of vegetation communities. Fire presence and absence at varying cycles or regimes affect plant community succession. Succession of plant communities, most notably the gradual conversion of shrublands to grasslands with high frequency fires and grasslands to shrublands with fire exclusion, is highly dependent on the fire regime.

Biomass and associated fuel loading will increase over time, assuming that disturbance or fuel treatment/reduction efforts are not realized. Depending on the success of fire exclusion activities and any prescribed burn plan ultimately designed for the Preserve, the current vegetation composition and density will tend to continue increasing volume, establishing exotic species, and/or continuing degradation of shrublands and persistence of annual grasses.

Wildfire disturbances can also have dramatic impacts on individual plants and plant composition. Heat shock, accumulation of post-fire charite, and change in photoperiods due to removal of shrub canopies may all stimulate seed germination (Keeley and Keeley 1984). The post-fire response for most species is vegetative reproduction and stimulation of flowering and fruiting. The combustion of aboveground biomass alters seedbeds and temporarily eliminates competition for moisture, nutrients, heat, and light (Wright and Heinselman 1973). Species that can rapidly take advantage of the available resources will flourish. It is possible to alter successional pathways for varying plant communities by varying the frequency and intensity of fire. This concept is a key component for fire management efforts in the Preserve.

Grassland Fire Effects

Annual grassland is the most common vegetation type on site, encompassing 236.7 acres. Annual grassland responses to fire are varied. An extensive review and analysis of the response to burning and grazing of California grasslands indicates that prescribed burning temporarily reduces exotic annual grasses but also results in increased exotic and native forbs (Rice 2005, Bainbridge and D'Antonio 2003, D'Antonio et al. 2003). These studies indicate that single prescribed burns often decrease exotic annual grasses, but they recover by the third year in the absence of additional disturbance. Grazing or follow-up burns hinder the recovery of exotic annual grasses and maintain forb cover, which would be beneficial to the Preserve.



- Fuel Model 1 (Grasslands, Disturbed Habitat)
- Fuel Model 8 (Riparian Woodlands)
- Fuel Model 9 (Oak Woodlands, Orchards)
- Fuel Model SCAL18 (Coastal Sage Scrub, Arrowweed Scrub)
- Fuel Model SH7 (Chaparral, Chaparral-Sage Communities)
- Fuel Model 0 (Non-Fuel, Developed)
- Fuel Model TU5 (Eucalyptus Woodland)
- Simon Preserve Boundary



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However, annual grassland responses to fire are varied. One effect that appears to be fairly common among exotic grasses is that lower-intensity grassland fires rarely damage seeds on or near the soil surface (Daubenmire 1968). One study included a May burn (following seed dispersal) to remove annual grasses from a severely degraded coastal sage scrub site in California (Cione et al. 2002). The investigators noted that there were many exotic annual grass seeds lying on the soil surface after the controlled burn. Since seeds on the soil surface are not generally exposed to high enough temperatures to cause mortality in a grassland environment, burn timing is most effective after desirable species have dispersed their seeds, but when target invasive species have their seed heads directly exposed to flames (DiTomaso and Johnson 2006). As such, the logical conclusion is that non-native grassland burns must be timed appropriately so that the seeds are consumed, resulting in decreased reestablishment of non-natives and reduced competition for annual forbs.

Diegan Coastal Sage Scrub Fire Effects

Diegan sage scrub occupies 236.2 acres (including disturbed areas). Species within this vegetation community include: California buckwheat, California everlasting (*Gnaphalium californicum*), goldenbush (*Isocoma menziesii*), and laurel sumac (*Malosma laurina*). Generally, sage scrub communities tend to lose their leaves and go dormant, creating dead, dry fuels that are readily available for burning (Carle 2008).

Following fire, typical sage scrub succession includes a predominance of annual herbs during the first year. These tend to decline in subsequent years without fire or other disturbances, as shrubs establish and attain greater cover. Perennial herb understory species, which may grow from re-sprouts, show low recruitment from the soil seed bank. Unlike herbaceous annuals, the overall diversity of perennial understory herbs remains constant the first few years following fire. New species continue to become established in recovering sage scrub, reaching a peak at 5 to 10 years after a fire. After the peak in species diversity, there is a general decline in perennial understory herb species, possibly attributable to shading effects from dominant shrubs (Wills 2000, Keeley and Keeley 1984).

Lack of fire will allow shrub cover to return to burn areas over time. Recovering shrub cover is less likely to burn in the first 20 years during typical weather conditions, but will burn under extreme fire events (Moritz 2003). The Preserve's vegetation is between 3 and 6 years old at the time of this report, still establishing following the 2007 fire. Once established, the shrub cover will increase in volume, and, following approximately 20 years, the hazard will increase corresponding with fuel age (Keeley 2005). Changes in land use will also affect the vegetation distribution pattern. For example, the encroachment of non-native plants is likely based on the proximity of residential development and ornamental landscaping to the Preserve.

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Chaparral Fire Effects

Mixed chaparral communities on site cover 24.5 acres, with mixed chaparral/sage scrub communities covering an additional 64.0 acres (including disturbed areas). Vegetation typically ranges from 1 to 3 meters (3 to 10 feet) tall with little herbaceous understory in mature stands. Chamise chaparral often occurs on xeric slopes and ridges. This vegetation community is adapted to repeated fires and responds via stump sprouting to reestablish after such disturbance (Holland 1986). Some species commonly associated with chamise chaparral include manzanita (*Arctostaphylos* spp.), ceanothus (*Ceanothus* spp.), birchleaf mountain-mahogany (*Cercocarpus betuloides*), bush poppy (*Dendromecon rigida*), and California buckwheat (Holland 1986). Chamise chaparral is the predominant chaparral type in Ventura, Los Angeles, San Bernardino, Riverside, and San Diego counties (Holland 1986).

Fire Behavior

Fire behavior modeling includes a high level of analysis and information detail to arrive at reasonably accurate representations of how wildfire would move through available fuels in high-fire hazard areas. Fire behavior calculations are based on site-specific fuel characteristics supported by fire science research that analyzes heat transfer related to specific fire behavior. Current and accepted fire research data from several programs that specialize in the study of wildland fire were utilized for the completion of this analysis for the Preserve. To objectively predict flame lengths and intensities, the FlamMap fire behavior fuel modeling system was applied using predominant fuel characteristics from representative fuel models observed on the Preserve. In addition to fuels data, topographic and weather data were utilized in developing fire behavior models for two separate weather conditions: summer (onshore flow) and fall (offshore flow). Results of fire behavior modeling efforts for the Preserve are presented in Appendix C.

Predicting wildland fire behavior is not an exact science. As such, the minute-by-minute movement of a fire will probably never be predictable, especially when considering the variable state of weather and the fact that weather conditions are typically estimated from forecasts made many hours before a fire. Nevertheless, field-tested and experienced judgment in assessing the fire environment, coupled with a systematic method of calculating fire behavior, yields accurate results (Rothermel 1983).

The FlamMap (version 3.0) software package (Finney 2004) is a GIS-driven computer program that incorporates fuels, weather, and topography data in generating static fire behavior outputs, including values associated with flame length fireline intensities. It is a flexible system that can be adapted to a variety of specific wildland fire planning and management needs.

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FlamMap is ideally suited for real-time predictions of the behavior of wildfires. The calculations that come from FlamMap are based on the BehavePlus Fire Modeling System algorithms but result in geographically distinct data sets based on GIS inputs. FlamMap model outputs allow wildland resource managers to predict rate of spread, fireline intensity, and flame length, which provide important insights about the characteristics of wildfire spread within and adjacent to high-value areas, such as preserved sage scrub. Each of the input variables used in FlamMap remains constant at each location, meaning that the input variables are applied consistently to each grid cell and that the fire behavior at one grid cell does not impact that at a neighboring grid cell. Essentially, the model presents a “snapshot” in time and does not account for temporal changes in fire behavior or the movement of fire across the landscape. As such, the results of the models contained herein should be utilized as valuable information sources and tools to prioritize fuel treatment options rather than as an exact representation of how a fire would behave on the Preserve.

The basic assumptions and limitations of FlamMap are:

- The fire model output describes fire behavior only in the flaming front. The primary driving forces in the predictive calculations are the dead fuels less than 0.25 inch in diameter. These are the fine fuels that carry fire. Fuels greater than 1 inch in diameter have little effect to carry fire, and fuels greater than 3 inches in diameter have no effect.
- The model bases calculations and descriptions on a wildfire spreading through surface fuels that are within 6 feet of the ground and contiguous to the ground. Surface fuels are often classified as grass, brush, litter, or slash.
- The software assumes that weather is uniform. However, because wildfires almost always burn under non-uniform conditions, length of projection period and choice of fuel must be carefully considered to obtain useful predictions.
- The system provides the average length of the flames, which is a key element for determining defensible space distances for minimizing structure ignition.

Fire Hazard

This section presents a discussion of fire hazard situations for the Preserve. This information was collected during initial site analysis and reviews of project data, fire behavior modeling results, and high-resolution aerial imagery and was integrated into the preparation of this document and associated recommendations.

1. Based on topography, vegetation, and fire history of the region, a large conflagration during Santa Ana wind conditions will likely enter the Preserve property from the east, as seen in the 2003 Cedar Fire and the 2007 Witch Fire. Fires during typical onshore wind

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patterns are likely to enter the site from either the adjacent WUI or from open-space areas southwest of the Preserve.

2. A WUI threat exists along the east, north, and western boundaries of the Preserve. Residential development is most dense along the eastern boundary, with lower density rural–residential development along the north and west boundaries.
3. Potential ignition sources not associated with residential development include San Vicente Road to the south and Old Julian Highway to the north.
4. Wildfires fueled by Santa Ana winds may move rapidly across the Preserve. Grassland, sage scrub, and chaparral fuels will be the predominant carriers of fire across the site. Steep slopes with even steeper walled drainages typify the topography of the Preserve. Fires in grassland fuels will be fast-moving ground fires, while those in chaparral or sage scrub fuels will move more slowly but produce greater flame lengths and associated heat output.
5. A fire originating in a structure in the sphere of influence of the Preserve could burn onto the Preserve.
6. Firefighting may be difficult on the Preserve due to limited access and steep terrain. Air attack will be an important component but may not be available or usable, depending on the extent of the fire event and/or the time of day and weather conditions.

The catastrophic wildfire threat for the Preserve is extreme when severe fire weather occurs, which will coincide with Red Flag Warnings periods. The National Weather Service declares Red Flag Warnings, which utilize sophisticated models of previous fire weather, humidity, and wind. The Preserve is located in Fire Weather Zone 250. Accordingly, Red Flag Warnings are issued when humidity is 15% or lower and sustained winds are 25 miles per hour (with gusts greater than or equal to 35 miles per hour), or when humidity is less than or equal to 10% regardless of wind.

5.3 Fire Response Plan

5.3.1 Fuel Management Units

The Preserve contains five fuel management units (Figure 10). Boundaries for each FMU correspond with site topography (e.g., ridgelines, valley bottoms), roads, or vegetation type boundaries, as well as one FMU specific to the WUI along the southeast and east side of the Preserve (Figure 10). Additionally, the Preserve maps in Appendices A-1 and A-2 contain important response information, including road widths, road types, topography, access points, FMU boundaries, and vegetation distribution. The intent is to guide firefighting operations during fire events while considering wildlife habitat management objectives. A color-coded fire

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response classification system has been developed for the Preserve, as presented in Table 9. There are three different fire response categories for the Preserve:

Green: FMUs include high-value response areas requiring assertive intervention. This response category indicates that management goals focus on reducing the fire return interval for habitat enhancement or that increased allocation of tactical resources is required as a rapid intervention method to minimize losses to high-value assets and resources.

Yellow: FMUs include standard tactical response areas. This response category is managed for fire containment but with consideration for the least impact possible for control. Fires in this response category will not typically be allowed to self-extinguish.

Red: FMUs where current management goals include fire and where fire will be allowed to burn but will be “guided” toward existing site features, such as roads, rock outcrops, and bare ground, or other control lines to encourage the fire to self-extinguish (as long as conditions allow a high probability of successful containment).

Note: During extreme weather, the responses indicated within each FMU type may not be able to be implemented due to extreme fire spread, intensity, or unpredictability.

Table 9 presents FMU response categories, and Table 10 provides the response category classifications by FMU.

**Table 9
Fuel Management Unit Response Categories**

Response Category	Response Level	Description	Fuel Management Unit Objectives
GREEN	Assertive	Fuel Management Units assigned “GREEN” status are managed for minimal fire losses. As such, incident response in “GREEN” FMUs is aggressive.	<ol style="list-style-type: none"> 1. Rapid fire containment 2. Fire spread minimization 3. All available tactical firefighting resources and methods may be utilized
YELLOW	Standard*	Fuel Management Units assigned “YELLOW” status are managed for fire containment with minimal biological damage created by the suppression operation.	<ol style="list-style-type: none"> 1. Fire containment and control 2. Minimize destruction of habitat 3. Utilize lowest biologically impacting fire suppression equipment and methods possible*
RED	Reserved*	Fuel Management Units assigned “RED” status are managed for minimal biological impacts. As such, fire suppression efforts focus on the least soil, plant, and wildlife impacting methods.	<ol style="list-style-type: none"> 1. Containment within FMU 2. No or minimal destruction or disturbance of habitat 3. Utilize only non-impacting fire suppression methods*

* When conditions dictate use of equipment or techniques that may result in biological disturbances within “YELLOW” or “RED” FMUs to control or extinguish a fire, priority is given to public safety and avoidance of catastrophic fire. Under such conditions, “impacting” fire suppression methods should be considered valid by the responding agency.

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Table 9 (Continued)

NOTE: Under “Red Flag Warning” conditions, severe fire weather subjects all FMUs to Response Category level elevation. Ultimately, implementation of the FMU recommendations will depend on site-specific fire environment conditions. It is anticipated that variations in the type of tactical response occurring on any given FMU during wildfire events will occur and will be addressed with post-fire monitoring and management.

**Table 10
Individual Fuel Management Unit Response Category Classification**

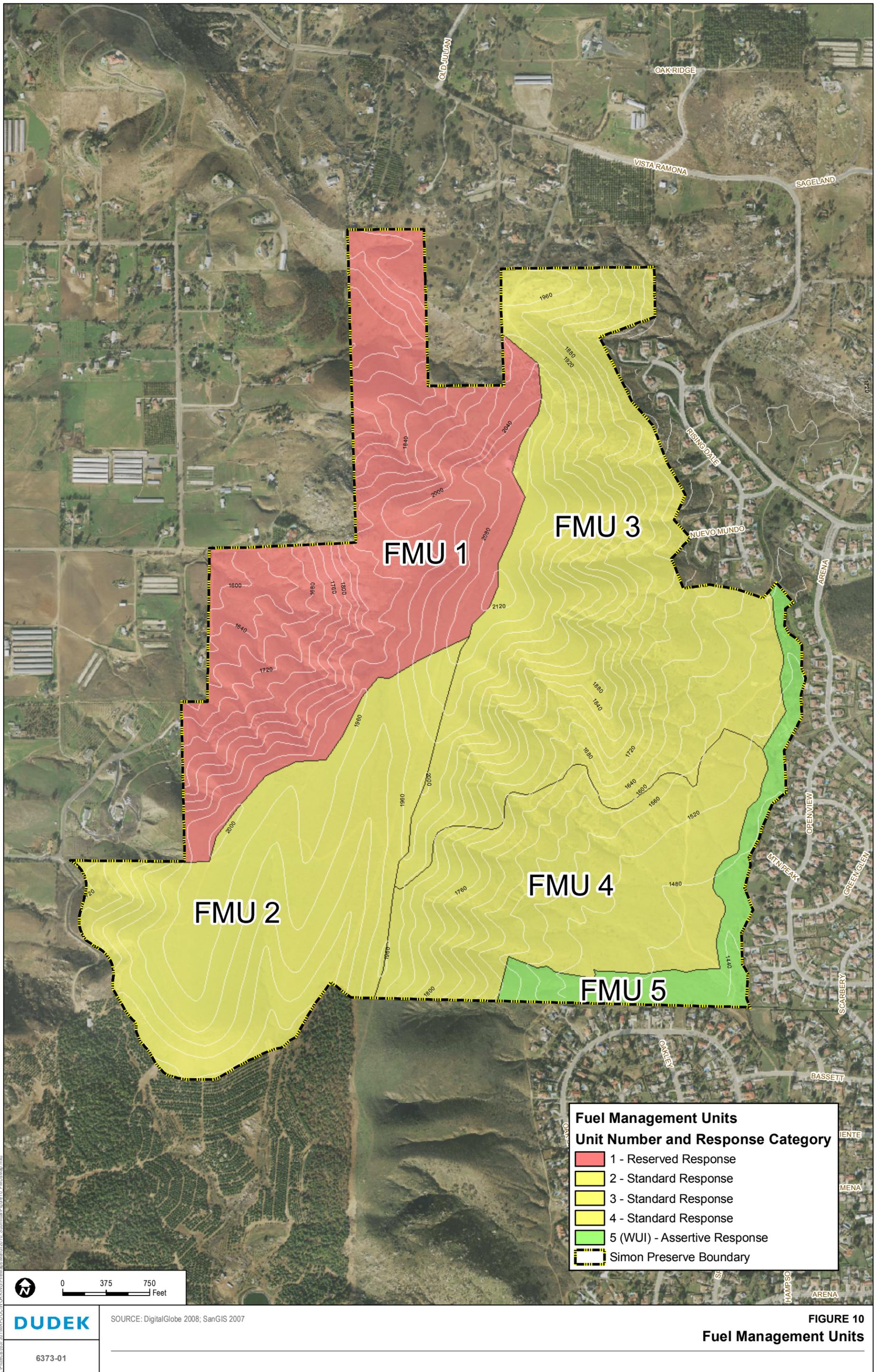
FMU	Acreage	Elevation Range (feet)	Maximum Slope (%)	Access	Structures Adjacent	Response Category**
1	160	1,580–2,128	45	Gated access, east end of Creelman Lane, east end of Hanson Lane, or south end of Woods Hill Lane	No	Reserved
2	133	1,780–2,100	30	Gated access, east end of Creelman Lane or south end of Woods Hill Lane (through FMU 1)	No	Standard
3	188	1,500–2,128	45	Gated access, dirt road off south side of Vista Ramona Road (between Calle Andrea and Arena Way)	Yes	Standard
4	107	1,460–1,960	30	Gated access, dirt road off north side of Bassett Way (between Bassett Court and Spangler Peak Road)	No	Standard
5 (WUI)	29	1,440–1,640	20	Gated access, dirt road off north side of Bassett Way (between Bassett Court and Spangler Peak Road), or dirt road off south side of Vista Ramona Road (between Calle Andrea and Arena Way)	Yes	Assertive

* When conditions dictate use of equipment or techniques that may result in biological disturbances within “YELLOW” or “RED” FMUs to control or extinguish a fire, priority is given to public safety and avoidance of Reserve-wide, catastrophic fire conflagration. Under such conditions, “impacting” fire suppression methods should be considered valid by the responding agency.

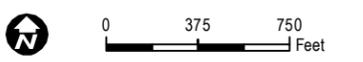
** The categories assigned to each FMU should be evaluated by the County of San Diego Department of Parks and Recreation Ramona Mountains District Park Manager annually before fire season and may be subject to change based on recent fire activity, changes in vegetative cover, or observations of sensitive species.

5.3.2 Short-Term Tactical Fire Suppression Plan

This section presents a tactical fire suppression plan for the Preserve. The plan includes individual response plans for each FMU identified in the following section. In addition to FMU-specific response plans, the tactical fire suppression plan includes discussion of primary contacts, Cal Fire response levels, access roads, and potential response staging areas.



Fuel Management Units	
Unit Number and Response Category	
	1 - Reserved Response
	2 - Standard Response
	3 - Standard Response
	4 - Standard Response
	5 (WUI) - Assertive Response
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Cal Fire is the primary responder to the Preserve, with assistance from the U.S. Forest Service and the Inter-Mountain Volunteer Fire Department. Both are extremely qualified for and experienced with responding to vegetation fires. The Ramona Fire Department would typically respond since the Preserve is within their boundaries via Automatic Aid. However, Ramona Fire Department would have a limited role and would be focused on structure fire protection as opposed to wildland firefighting.

Cal Fire utilizes three levels of dispatch and response based upon weather conditions and time of year. The three levels are:

- Low – includes two engines (Type III) with three personnel each
- Medium – includes three engines (Type III) with three personnel each, one battalion chief, one mid-sized bulldozer, one type III helicopter, and one 16-person hand crew
- High – includes five engines (Type III) with three personnel each, one battalion chief, two mid-sized bulldozers, one airtactical aircraft(AA), two air tankers, and one Type III helicopter.

Dispatch levels are based on weather conditions. Low dispatch occurs during the winter months from November through May. Medium and High dispatch occur during the normally declared fire season from June through October. There is some variation in the timing of the dispatch levels, based entirely on weather.

Cal Fire stations responding would include the Witch Creek, Mount Woodson, Flinn Springs, and Julian Stations. The nearby tactical air attack base located at Ramona Airport would provide air support.

Fire Response

This Vegetation Management Plan stresses the need for fire response to minimize impacts to natural resources, when possible, by using pre-planned fire suppression tactics and actions within the boundary of the Preserve. For example, drivable utility maintenance roads and trails (see Appendix A-1) within portions of the Preserve are adequate for fire access during non-extreme weather. They are also useful for conducting fire operations and may serve as fuel breaks for non-extreme weather fires.

The need for ground-disturbing activities should be carefully considered based on the location of roads and other valuable resources. Fire suppression air support with fire retardant drops may be a component of responses to all FMUs for achieving goals and objectives, especially under conditions that would accelerate wildfire spread. Air support may not be available under extreme conditions or at night, and in these situations, response categories may become

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secondary to public safety. Fires occurring within open space areas have the demonstrated potential to move into other response category FMUs or into urban areas, consequently overwhelming available fire resources.

Response to the Preserve for fire suppression should include existing road access for firefighting personnel, type I engines (limited to paved roadways just outside the Preserve), type III engines, fire crews, air attack and fire retardant, helicopters, and air tankers. Fire suppression actions may include one or more of the following: direct attack with engines, fire crews, helicopters, and firing operations within the FMUs, according to the pre-planned management guidelines. Line construction activities within the Preserve would be best carried out by hand crews. Dozers and road graders may be activated but should not be put into operation on the Preserve itself unless necessary for improving existing roads for engine access or constructing line or secondary line for preservation of high-value resources.

5.3.3 Primary Actions and Contacts for Wildfire Emergency

When a fire has been spotted on the Preserve, the following information should be collected and provided to the Cal Fire incident response team:

1. FMU number
2. Response category
3. Response map number
4. Most direct access route
5. Type of fuels
6. Sensitive resources (e.g., cultural resources).

Since the site currently has no full-time site manager, has no “staging” areas, and is less visible than neighboring Ramona Preserves, the site is typically patrolled once per week, usually on a Saturday or Sunday when visitation is typically highest. Lack of DPR patrol presence will likely result in deficiencies with regard to the information provided to Cal Fire. Therefore, wildfire reporting may not include all of the details recommended herein. However, the more information that is provided, the higher the likelihood that involved FMUs will be provided the type of response prescribed according to their response category and that ground disturbance will be minimized.

The following persons/agencies should be contacted in the event of a wildfire on the Preserve. The contact information should accompany the response maps and should be updated routinely by DPR park staff assigned to the Preserve.

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- California Department of Forestry and Fire Protection (Cal Fire)
911 (Emergency)
- Ramona Fire Department 760.788.2250 (Non-emergency)
911 (Emergency)

- County of San Diego Department of Parks and Recreation
Ramona/ Mountains District
District Park Manager
858-966-1366

or

On-duty Ramona Preserves Rangers
619.838.7215

- Neighboring Landowners
Via County of San Diego Mass Notification System (requires all telephone numbers to be registered)

5.3.4 Roads/Access

Road access on the Preserve is relatively limited due to terrain. Consequently, narrow roads no wider than 8 to 10 feet are located primarily along ridgetops, with a few mid-slope roads associated with the east–west power line alignment in the south–central portion of the Preserve. Primary site access is gained at the south end of Woods Hill Lane through a gated access point that connects to the primary north–south ridgetop road that bisects the Preserve. Another gated access to the site is from the south off Bassett Way. Access for each FMU is described in Table 10.

5.3.5 Fuel Breaks

There is an existing network of roads that may be utilized as fuel breaks by fire personal in fire suppression efforts. However, these roads are approximately 10 feet wide and will not act as adequate firebreaks during wind-driven wildfires. No other known natural or man-made fuel breaks were identified on site. Based on the topography of the Preserve and the existing road network, it is not recommended that additional breaks be created.

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5.3.6 Emergency Staging Areas

Due to the terrain on the Preserve, it is not anticipated that fire response staging areas will be situated on the Preserve. Staging areas, which are important for incident command and to organize, plan, and implement firefighting strategies, typically cause higher ground disturbance from personnel, vehicles and equipment in confined areas. Staging areas for fires on the Preserve will likely occur off site in the flatter areas north and west of the Preserve.

5.3.7 Fire Hydrants

No fire hydrants are located on the Preserve. Fire hydrants are located within adjacent residential development areas and may be utilized during a fire event to refill engines, as necessary.

5.3.8 Other Water Sources

Other water sources which may be available during a wildfire event include:

- The water storage tank in the north–central portion of the Preserve at the southern end of Woods Hill Lane.
- An agricultural reservoir immediately south of the Preserve. Engine access may be restricted, but helicopter use is likely.

6.0 MANAGEMENT DIRECTIVES

6.1 Invasive Species Removal

The long-term management directive for invasive species removal considers invasive species on their risk of reducing habitat quality over time. Aggressive invasive non-native species on the Preserve, such as tamarisk, should be addressed as a high priority, while the remaining species should be eradicated on a lower priority basis as funding becomes available. Removal methods are described in Section 3.2.

6.2 Restoration

The directive for habitat restoration is to reestablish or enhance the biological functions and values of habitat that have been degraded from either human or natural causes. There are currently no imminent restoration needs on site. However, long-term restoration activities will occur following landscape-changing disturbances that remove, damage, degrade, or alter the desired habitat. Restoration methods will be customized to the site within the Preserve, based on the type of disturbance, and will require preparation and implementation of a restoration plan.

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Restoration will range from active revegetation, which recreates habitat, to passive management, which supports natural reestablishment of a site. Restoration techniques recommended for the Preserve are discussed in Section 4.2.

6.3 Fire Management

The long-term strategic fire management plan considers strategic fire prevention activities, fire suppression with regard to fire effects on habitat, and post-fire monitoring and rehabilitation. The long-term strategic fire plan for the Preserve must prioritize public safety while meeting habitat management goals. Due to the continued human population growth in the region, public safety requirements will require increasing fuel reduction activities in WUI and intermix areas. Fuel reduction in these areas will be most successfully accomplished through a combination of maintenance on adjacent private property that may include experienced fuel reduction contractors and more robust, ecologically based management and maintenance on the Preserve, as described below. A component of the long-term strategic fire protection plan will be public education, as prevention activities are more successful when coupled with active education programs.

Fuels Management

Successful fire management requires pre-planning and utilization of fire prevention techniques and strategies. High-value resource areas must be identified, and appropriate wildfire hazard/fuel reduction practices must then be implemented and maintained. With those concepts in mind, high-value resource areas within the Preserve were identified, and appropriate methods for reducing potential hazard are provided below. Table 11 provides a summary of the high-value resource areas acknowledged for the Preserve and the associated fire prevention strategy recommended for achieving long-term management goals.

Table 11
Fuel Reduction Prescriptions by Fuel Management Unit

Fuel Management Unit	High Value Resource	Fire Prevention Practice
1	Annual grassland	Annual mowing and grazing would provide the most feasible form of fuel reduction and can be focused adjacent to the ridgetop road extending south from Woods Hill Lane. Prescribed fire is also an option for the grasslands in FMU 1. Routine burning or grazing of the grasslands in this FMU (and of grasslands in FMU 2) can provide a valuable north-south fuel break that may assist in slowing a fuel- (not wind-) driven wildfire.
1	Coastal scrub	Reduction of fires through strategic mowing/fuel reduction along ignition source areas, especially access roads, and rapid response for extinguishing

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Table 11 (Continued)

Fuel Management Unit	High Value Resource	Fire Prevention Practice
		wildfire, especially in the western portion of this FMU.
2	Annual grassland	Annual or semi-annual grazing would be the most likely form of fuel reduction for FMU 2 due to its slopes and extent of grassland. Prescribed fire may also be an option in this FMU due to the lower fuel volume, but it would need to compliment habitat management objectives. Routine burning or grazing of the grasslands in this FMU (and of grasslands in FMU 1) can provide a valuable north-south fuel break that may assist in slowing a fuel-driven wildfire.
3	Coastal scrub and southern mixed chaparral	Steep terrain in this FMU limits access and the amount of mowing or thinning that would be possible. Grazing is not applicable due to the limited extent of grasslands. Minimizing fire spread during wildfire will be a key component to habitat enhancement in this FMU. Timed prescribed fire could be used on a long-term basis, but not until wildfire frequency is reduced substantially. Strategically placed thinning projects may be beneficial in reducing wildfire spread but should be consistent with habitat management goals.
4	Coastal scrub	Steep terrain in this FMU limits the amount of mowing or thinning that would be possible. Grazing is possible but may be difficult to manage. Minimizing fire spread during wildfire will be a key component to habitat enhancement in this FMU. Timed prescribed fire could be used on a long-term basis to strategically reduce fuel loads.
5 (WUI)	Residences	This zone is characterized by the adjacent residential development to the east. Outside of riparian areas, fuel reduction by manual thinning, mowing, and exotics removal should be conducted routinely to minimize fire spread and ignition potential from residential development.

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In summary, each of the FMUs includes high-value resources that may be treated for fuel reduction practices, potentially including grazing, thinning, annual mowing, herbicides, and/or prescribed burning. Potential fire prevention and fuel reduction practices include:

- Grazing – timing, avoid introduction of exotics
- Mowing – timing, avoid wet soils and potential for ignition
- Herbicides – timing, maximize effect on non-native grasses
- Prescribed fire – timing, spring preferred, some winter burning possible
- Hand tools/thinning – especially on adjacent private properties that push into and will continue to push into the interface/intermix areas of the Preserve; residents will be responsible for maintaining their own defensible space
- Fuel or firebreaks – augment existing roads, bare ground, rock outcrops with fuel reduction and maintenance.

The following fuel management recommendations should be implemented on the Preserve:

- **Grazing:** Grazing is an effective fuel reduction method and can be compatible with Preserve management goals.
- **Mowing:** Mowing is a common and successful method for reducing fuel loads and is compatible with Preserve management goals; it may be of limited use in rocky and rugged terrain.
- **Prescribed Fire:** Prescribed fire on this Preserve can only be implemented by Cal Fire or a similar fire authority with experience and certifications to conduct burns. Prescribed fire can be the least expensive but overall least feasible form of fuel reduction. The advantages of prescribed fire must be weighed against difficulties in getting burns implemented, potential for escape, air quality issues, public opposition, and propensity to result in non-native grass and weed reestablishment if implemented too frequently.
- **Thinning:** Thinning can reduce fuel continuity and loading by selective removal of dead and dying, overly dense, horizontal and vertical bunches, and exotics. Thinning is most useful in the interface and intermix areas around high-value resources, such as residences. Adjacent residences would have to maintain their own defensible space.
- **Fuel Breaks:** Fuel breaks provide areas of removed fuels that play an important role in helping contain wildfires. The Preserve currently includes numerous roads from which firefighting personnel can conduct operations. Based on the topography of the Preserve and the existing road network, it is not recommended that additional breaks be created.

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Preserve Management

The following management recommendations are provided to compliment fuel reduction recommendations for the Preserve:

- **Gate and Access Road Signage:** Gates and signs with access road names, road types (e.g., paved, dirt, weight capacity or limitations), and road widths will benefit Cal Fire responders and complement Preserve maps, resulting in more efficient responses.
- **Illegal Access:** Off-highway vehicles and shooting are other potential sources for fire that must be managed through restricting access (e.g., fence, gates), more frequent patrols, and higher profile presence of Preserve staff.
- **Public Education:** Private property owners in the interface or intermix (located adjacent to or surrounded by open space areas) can be encouraged to play an active role in reducing the potential hazard. It will also be beneficial if the public understands the management actions occurring on the Preserve, such as grazing, mowing, herbicides, and prescribed fire. As such, this plan recommends a concerted effort to reach property owners who are situated in locations that may be affected by wildfire on the Preserve or who may serve as ignition points to Preserve fires. Educational material can be customized for these homeowners to include discussion of the importance of the Preserve. Standard measures for implementing a 100-foot fuel modification/defensible space zone can be provided from materials available from Cal Fire and from the County of San Diego Department of Planning and Land Use². As part of the public education program, private property owners should be encouraged to participate as “eyes on the Preserve” to help curb illegal access and report potential problems.
- **Ignition Reduction:** It is well documented that anthropogenic sources are compressing the fire return interval and resulting in shrubland conversion to largely non-native annual grassland. It is recommended that fuel modification buffers be provided for all primary and secondary roads that may affect the Preserve.
- **Fire Suppression:** Fire suppression, in combination with other management methods in targeted Preserve habitat management areas, is the priority for the Preserve. Lengthening the fire return cycle to an optimal frequency will require fuel reduction experiments, research, monitoring, and analysis as part of the overall management approach. The optimal fire frequency in sage scrub may be from 10 to 60 years or more. It may be difficult to achieve the longer fire return intervals given the current and projected ignition sources that may affect the Preserve. However, results of site data analysis will more

² Online at: http://www.fire.ca.gov/cdfbofdb/pdfs/4291finalguidelines2_23_06.pdf and http://www.sdcountry.ca.gov/dplu/fire_resistant.html

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firmly establish the optimal return intervals to meet habitat goals, or if additional steps need to be implemented, to lengthen the return of fire for a given FMU.

Prescribed Fire

Prescribed burning should be considered as one alternative for habitat enhancement and fuel reduction on the Preserve. Grazing, mowing, and herbicide application should be utilized as the first options for fuel reduction, and prescribed fire should be used only where appropriate, such as in conjunction with burning on neighboring open space lands. Prescribed fire is not recommended in WUI/intermix areas due to potential hazards associated with burn operations. It should only be considered for areas where large expanses of grassland are available for burning, with minimal risk to public safety and property. Within the larger areas, smaller blocks should be selected to enable wildlife use of unburned areas immediately following fire and loss of habitat.

Despite the potential complications associated with prescribed fire, as discussed previously, fire provides benefits that cannot be mimicked by grazing, mowing, or herbicide use. However, it is anticipated that wildfire will continue to occur on the Preserve due to the numerous and increasing ignition sources in the region and may fulfill some of the beneficial fire effects that are lacking from alternative management methods.

Prescribed fire occurs in two forms: (1) natural fire occurring primarily through lightning strikes; and (2) intentional, managed fires. If natural fire occurs on the Preserve, and the fire poses no threat to life or high-value resources, the fire may be allowed to burn if it meets the FMU-specific management objectives. If unsafe conditions exist (e.g., high winds, low humidity, high temperature) and, without suppression, it has a high likelihood of burning into areas of fire exclusion or threatening valuable resources on or off site, then assertive suppression should be pursued. Intentionally managed fires are planned ignitions for purposes of reducing fuels primarily for public safety or habitat improvement, are regulated by all applicable laws, and are managed by Cal Fire's Vegetation Management Program. Where prescribed burning is feasible (FMU 1-4), it shall be conducted under permit from Cal Fire, or under contract with Cal Fire under the statewide Vegetation Management Program.

Winter burns, when weather typically allows for prescribed burns, will usually result in non-native species dominance (Keeley 2005). Avoidance of winter burns is recommended, with spring burns being the preferred period, although experimental winter burns may provide insight into the vegetative response on this site. It is recommended that a trained and experienced fire ecologist be involved to help determine the optimal timing of burns to favor annual forbs and open, bare ground patches.

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Post Fire Management

Erosion Control

One of the first concerns following wildfire is stabilization of soils in the burn area, especially if sloped areas are included in a burn. A goal should be to have erosion-control best management practices in place as soon as possible and before the onset of the winter rainy season. There are various erosion-control practices available for slowing the rate of erosion. Recent research indicates that mechanical rehabilitation treatments, including straw mulch, hay bales, and jute rolls, are more predictable for reducing soil erosion and post-fire hydrologic problems than seeding or other treatments (Robichard et al. 2000). Mulching may introduce exotics (Kruse et al. 2004), so erosion potential should be high before the decision to place these erosion-mitigating features in the Preserve is finalized.

Research and Monitoring

Because this Plan is based on strategies that are commonly utilized for fire management and for habitat enhancement but are untested on the Preserve and may require additional experimentation, pre- and post-fire research and monitoring are strongly recommended. The following list identifies primary areas for potential research, experimentation, and monitoring:

Ongoing Vegetation Management

- Identify areas that are in particular need for disturbances and in need of re-burning to maintain designated habitat value
- Experimentally determine the optimal disturbance frequency
 - Experiment with 4-, 5-, and 7-year mowing, grazing, and burning of FMUs
 - Efficacy of “guided or controlled” wildfires to provide the benefits associated with prescribed burning
 - Mowing and grazing effects on annual grasslands
 - Low-cost native grass reestablishment
- Maintain fire frequency between 4 and 8 years to control non-native grasses
- Two permanent plant transects in each FMU completed and analyzed each year
- Study protocol to be adjusted or terminated after determining that fire frequencies are detrimental or are suitable.

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Long-Term Monitoring

- Plant Community Response
 - Follow Resource Management Plan guidelines for monitoring
 - Qualitative and quantitative data
 - Annually, prior to and following burn
- Animal Community Response
 - Follow Resource Management Plan guidelines for monitoring
 - Mammal monitoring surveys using live-trapping techniques
 - Avian monitoring surveys using transects of point counts
 - Herpetile and ground invertebrate monitoring surveys using pit-fall traps

DPR staff will review the monitoring results and adapt the implementation of the management guidelines contained in this Plan.

Data Management

Data management is an important aspect for fire management on the Preserve. Assuming research and monitoring information is collected as recommended in this and other Preserve plans, it will be necessary to house that information within a secure database in a format that is compatible with statistical and trend analysis software applications. Over time, data analysis results will become the basis for fire management adaptations to more closely match Preserve management goals should current recommendations prove inadequate. Data collected before, during, and after disturbance events should be made available to DPR park staff managing Preserves with similar habitat management goals so that larger data sets can be evaluated. Optimal disturbance return intervals may vary by site, and comparisons among DPR Preserve land data will be important for long-term fire and habitat management within DPR properties.

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APPENDIX A-1

Preserve Map with Response Categories
(Map pocket in back)

APPENDIX A-2

Preserve Map with Vegetation Distribution
(Map pocket in back)

APPENDIX B

Confidential Sensitive Archaeological Resources Survey Locations

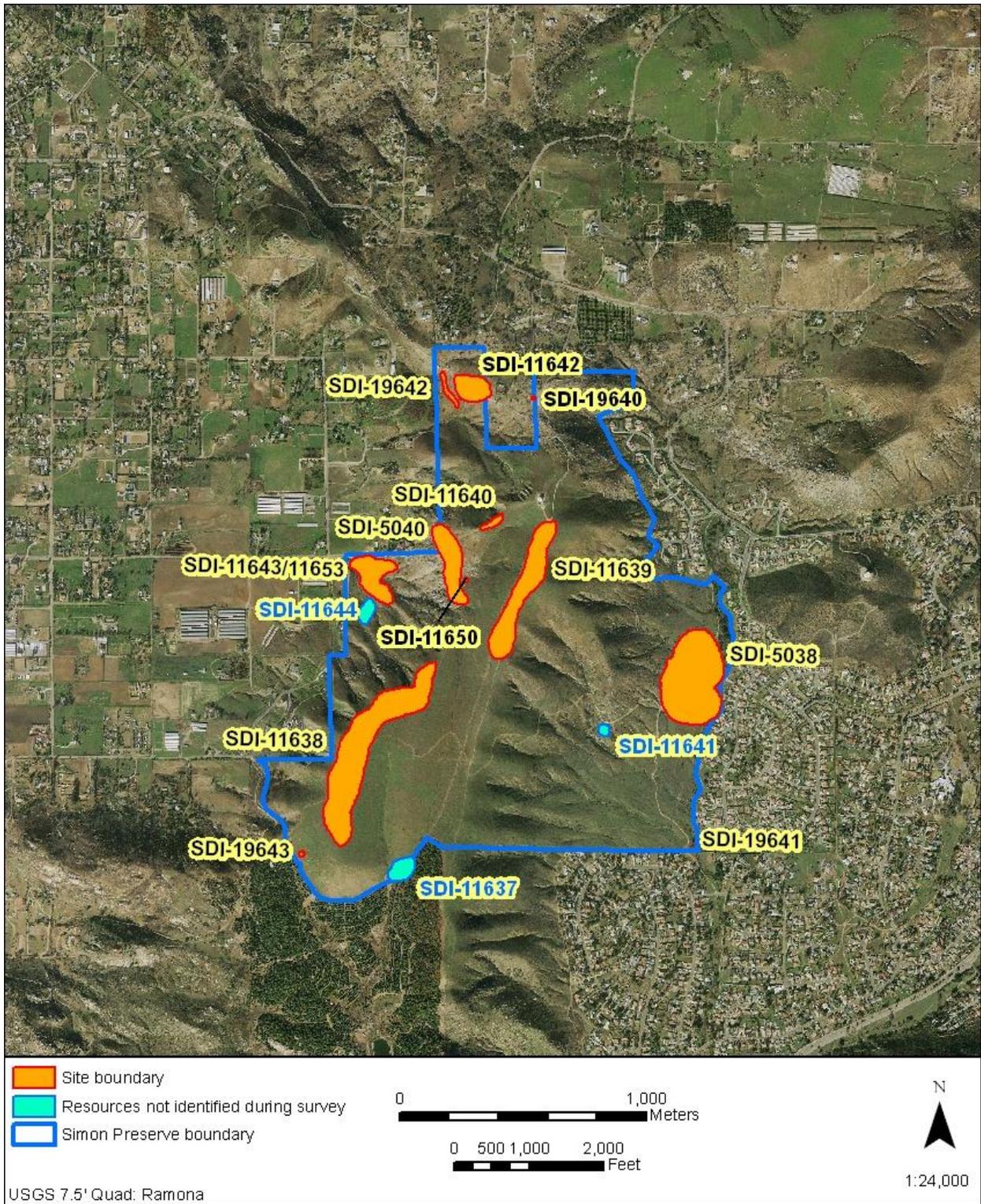


Figure 14. Cultural resources within Simon Preserve shown on aerial photograph (Confidential Appendix B).

APPENDIX C
Fire Behavior Modeling Results

APPENDIX C

Fire Behavior Modeling Results

FUELS CLASSIFICATION

Reliable estimates of fire behavior must consider the relationship of fuels to the fire environment and the variations in these fuels. Natural fuels are made up of the various components of vegetation, both live and dead, that occur on a site. The type and quantity will depend upon the soil, climate, geographic features, and the fire history of the site. The major fuel groups of grass, shrub, trees, and slash are defined by their constituent types and quantities of litter and duff layers, dead woody material, grasses and forbs, shrubs, regeneration, and trees. Fire behavior can be predicted largely by analyzing the characteristics of these fuels. Fire behavior is affected by seven principal fuel characteristics: fuel loading, size and shape, compactness, horizontal continuity, vertical arrangement, moisture content and chemical properties.

All vegetation is considered fuel. All vegetation will burn; however, some species require more heat in order to ignite and propagate flame. The moisture content of vegetation is an important component; dry vegetation will ignite more rapidly, whereas green vegetation must lose its moisture before it will ignite. Consequently, shrubland vegetation with high oil content (above 6%) will burn more quickly and hotter than vegetation with high leaf moisture levels and low oil content levels. More than 90% of the flaming front of a wildfire is composed of fuel less than 0.5 inch in diameter and is consumed in minutes. Fuels larger than 1 inch in diameter are termed “residual” fuel and may require several hours to burn out. This larger fuel does not contribute to the forward rate of spread of the fire. The following factors describe the relationship between vegetation characteristics that affect fire behavior:

Fuel loading is defined as the oven dry weight of fuels in a given area, usually expressed in tons per acre. Natural fuel loading varies greatly by vegetative or fuel types in addition to the different size classes of fuel particles. Vegetation types can be rated as light, moderate, or heavy. Each rating is an estimate of the dead or live surface fuels that are less than 3 inches in diameter. Although specific measurements were not taken, based on the vegetation types identified in the cursory survey of the Simon Preserve (Preserve), the different vegetation types can generally be assigned a moderate to high rating.

Measuring the intensity, force, and destructive potential of wildfire is accomplished by observing flame lengths produced by burning vegetation. A direct relationship exists between the amount of energy released during burning (per second) and the length of flame generated. The standard for measuring energy release in the United States is the British Thermal Unit (BTU). One BTU is defined as the amount of energy required to increase the temperature of 1 pound of water 1°F (a standard kitchen match or candle flame is approximately one BTU).

APPENDIX C (Continued)

Size and shape affect the surface area to volume ratio of fuels. Small fuels have a greater surface area to volume ratio than larger fuels. Dead fuels are separated into four size classes: (1) grasses, litter, or duff less than 0.25-inch diameter; (2) twigs and small stems 0.25– to 1-inch diameter; (3) branches 1- to 3-inch diameter; and (4) large stems and branches greater than 3-inch diameter. The fine fuels less than 0.25 inch in diameter are most important for fire behavior analysis because their ignition time is less, and their fuel moisture content changes rapidly. This characteristic is typical for the grasses that were identified within and adjacent to the Preserve.

The arrangement, size, and surface area of vegetative fuels play an important role in fire behavior and spread potential. Dense, concentrated biomass may burn evenly; however, when overall size decreases and surface area increases (as seen in native shrub stands), burning patterns change, resulting in faster ignition and spread. Live shrubland and grassland vegetation generally exhibit high surface to volume ratios. Standing grass, coastal sage scrub, and chaparral have high surface area to volume ratios, whereas forest litter and chipped or cut biomass exhibit very low surface to volume ratios.

Compactness, or spacing between fuel particles, affects the rate of combustion. For example, fuel particles that are closely compacted have less surface area exposed and less air circulation between particles and thus are slower to combust. The thick duff layer found underneath a mixed forest is an example of a tightly compacted fuel, whereas the open, dead branches on coastal sagebrush are considered a loosely compacted fuel. The fuels within and adjacent to the Preserve are loosely spaced with adequate air circulation required to carry a fire.

Horizontal continuity is the extent of horizontal distribution of fuels at various levels or planes. The vegetative types within various portions of the Preserve were analyzed for horizontal continuity and vertical arrangement. Fuels are either rated as uniform or patchy. Uniform fuels are evenly distributed and occur in a continuous, non-interrupted cover across the landscape. Patchy fuels are not continuous.

Vertical arrangement is defined as the relative heights of fuels above the ground, as well as their vertical continuity. Both of these vegetation characteristics influence the ability of fire to reach various fuel levels or strata. Vegetation of various heights that can transport fire from the low-level brush to tree canopies is called a fuel ladder and may create what is called a “crown fire.” When tall grasses and shrubs grow around trees with low hanging branches, the result is a fuel ladder. When a ground fire climbs the fuel ladder into the crowns of trees, it can spread canopy to canopy, creating higher fire intensity and firebrands.

Fuel moisture content is defined as the amount of water in fuels. The moisture content of plant materials plays a major role in the ignition, development, and spread of fires. Fuel moisture

APPENDIX C (Continued)

controls the current flammability of fuels both living and dead. During the most active growing periods of spring, the moisture content of plant foliage may be quite high. As the season progresses, a plant's moisture content declines until late summer or early fall when the plant becomes dormant or completely dies. Fine fuels, less than 0.25 inch thick, are most responsible for the spread of fire and have highly variable fuel moisture contents depending on the relative humidity of the air. Live fuel moisture content during the peak fire season (October through December) is estimated to be 60% to 80% in the drier open areas. This can potentially drop to less than 60% under extreme, dry wildfire conditions.

There are two types of fuel moisture values to consider: (1) dead fuel moisture, with measurements of 1-, 10-, 100-, and 1,000-hour time-lag; and (2) live fuel moisture.

Dead fuel moisture percentages are determined by temperature, aspect, time of day, relative humidity, and time of year. One-hour time-lag fuel is less than 0.5 inch thick, 10-hour time-lag fuel is between 0.5 inch and 1 inch thick, 100-hour time-lag fuel is between 1 and 3 inches thick, and 1,000-hour time-lag fuel is greater than 3 inches thick. One-hour time-lag fuel can reach equilibrium with the surrounding atmosphere in 1 hour, or within minutes when air temperature exceeds 80°F and relative humidity is below 25%. One-hour time-lag fuel moisture may be calculated using a set of tables that reference time of day, month, aspect, slope, temperature, and relative humidity. Ten-hour, 100-hour, and 1,000-hour time-lag fuel can take up to 10 hours, 100 hours, or 1,000 hours to reach equilibrium with the surrounding atmosphere, respectively. In Southern California, 1-hour, 10-hour, and 100-hour time-lag fuels are usually given equal value. One thousand hour time-lag fuel, which occurs in more heavily wooded environments (i.e., timber), is generally used in measuring drought effects. Forests are considered "critical" when 1,000-hour fuel measurements are less than 15% (as a frame of references, kiln-dried wood moisture averages 22%).

Despite variations in the topography and disturbance history of the Preserve, vegetative cover is classified into three main types: grass, chaparral, and coastal sage scrub. Frequent fires have created low-volume fuel beds throughout much of the Preserve. Although most fuels occur in the 1-hour size class, pockets of 10- and 100-hour fuels can be found, primarily in the woodland vegetation types on site.

Live fuel moisture is described as the moisture in leaves and woody portions of a plant. Field measurements of live fuel moistures are calculated by cutting small branches (less than 3 inches in diameter), weighing the branch, placing it in a low-temperature oven for 12 hours, removing the branch, and weighing it again. The difference in weight is the loss of moisture in the leaves and woody portion of the branch. Consequently, live fuel moisture may exceed 100% of the dry

APPENDIX C (Continued)

weight of the plant. Live fuel moisture is the highest in the spring and early summer, and the lowest in late summer, fall, and early winter. This measurement is a valuable tool in predicting wildfire potential for a general area.

Chaparral and coastal sage scrub are common Southern California vegetation types found in many upland locations and generally have reduced fuel moisture levels. Conversely, riparian vegetation, including willow (*Salix* spp.), coast live oak (*Quercus agrifolia*), and mulefat (*Baccharis salicifolia*), has higher leaf moisture values than vegetation growing in drier, more xeric sites. The importance of fuel moisture in examining fire hazard is that higher moisture levels ultimately require higher BTU output to ignite or sustain ignition. Consequently, fuel arrangement, along with fuel chemical/moisture content, plays an important role in wildfire combustion, spread, and heat output. Fuel moisture is a significant component, as vegetation requires external heat and energy to reduce moisture levels before it will ignite. High winds, low relative humidity, and/or high temperatures begin the process of removing fuel moisture, thus allowing vegetation to ignite and burn more rapidly. Consequently, lower fuel moisture values, including both dead and live fuel moistures, result in increased fire intensity. Moisture-laden fuels inhibit complete combustion while simultaneously producing excessive smoke output.

Fuel chemical properties include the presence of volatile substances such as oils, resins, wax, and pitch. These also affect the rate of combustion. Chaparral and sage scrub vegetation have high amounts of these volatile substances that contribute to rapid rates of spread and high fire intensities.

Oil and moisture contents vary between fuels and fluctuate depending on the time of year. For example, black sage may have an oil content approaching 20% of its weight in dry summer or autumn months, but, in the spring, when sufficient groundwater is available, moisture content values can exceed 300%. When stressed during extreme dry weather conditions, numerous chaparral and coastal sage scrub species may react explosively when moisture falls below 60%, whereas larger shrubs may require higher energy to sustain ignition.

FUEL MODELS

All nine fuels characteristics are descriptors that help define the 13 standard fuel models (Anderson 1982), the more recently developed 40 fuel models (Scott and Burgan 2005), and five custom fuel models developed for Southern California (Weise and Regelbrugge 1997). Six fuel models (models 1, 8, 9, SCAL 18, SH7, and TU5) were used in the FlamMap analysis for the

APPENDIX C (Continued)

Preserve and are required inputs for the mathematical fire spread computations. Table 1 provides details of the six fuel models used in the analysis conducted for Preserve.

Table 1
Fuel Model Characteristics

Fuel Model	Description	Tons/acre; Btu/lb	Fuel Bed Depth (Feet)
1	Short grass	0.7 tons/acre; 8,000 Btu/lb	1.0
8	Closed timber litter	5.0 tons/acre; 8,000 Btu/lb	0.2
9	Hardwood litter	3.5 tons/acre; 8,000 Btu/lb	0.2
SCAL18	Sage/buckwheat	9.7 tons/acre; 9,200 Btu/lb	3.0
SH7	Very high load dry scrub	14.4 tons/acre; 8,000 Btu/lb	6.0
TU5	Very high load, dry climate timber-shrub	14.0 tons/acre; 8,000 Btu/lb	1.0

WILDLAND FIRE BEHAVIOR MODELING

Fire behavior was analyzed for the Preserve site using FlamMap fire behavior modeling software and local topographic, fuels, and weather data. The FlamMap output data provide an indication of how vegetative fuels will burn under specific fuel, weather, and topographical conditions.

Fuel models used in the FlamMap analysis are classified into four groups based upon fuel loading (tons/acre), fuel height, and surface to volume ratio. Fuel model classifications were made during field analysis and in conjunction with available vegetation maps of the Reserve. The following list of fuel types describes the classification of fuel models based on vegetation type:

Grasses Fuel, Models 1 through 3. These models represent the fast moving, light, flashy fuels found in grassland landscapes.

Brush Fuel, Models 4 through 7, SCAL 14 through 18. These models are designed to represent the higher-intensity chaparral and sage scrub dominated landscapes.

Timber Fuel, Models 8 through 10. Timber models are selected to represent the riparian woodland or ornamental forested landscapes.

Logging Slash, Fuel Models 11 through 13. These models are used to represent slash; none were utilized for the Preserve.

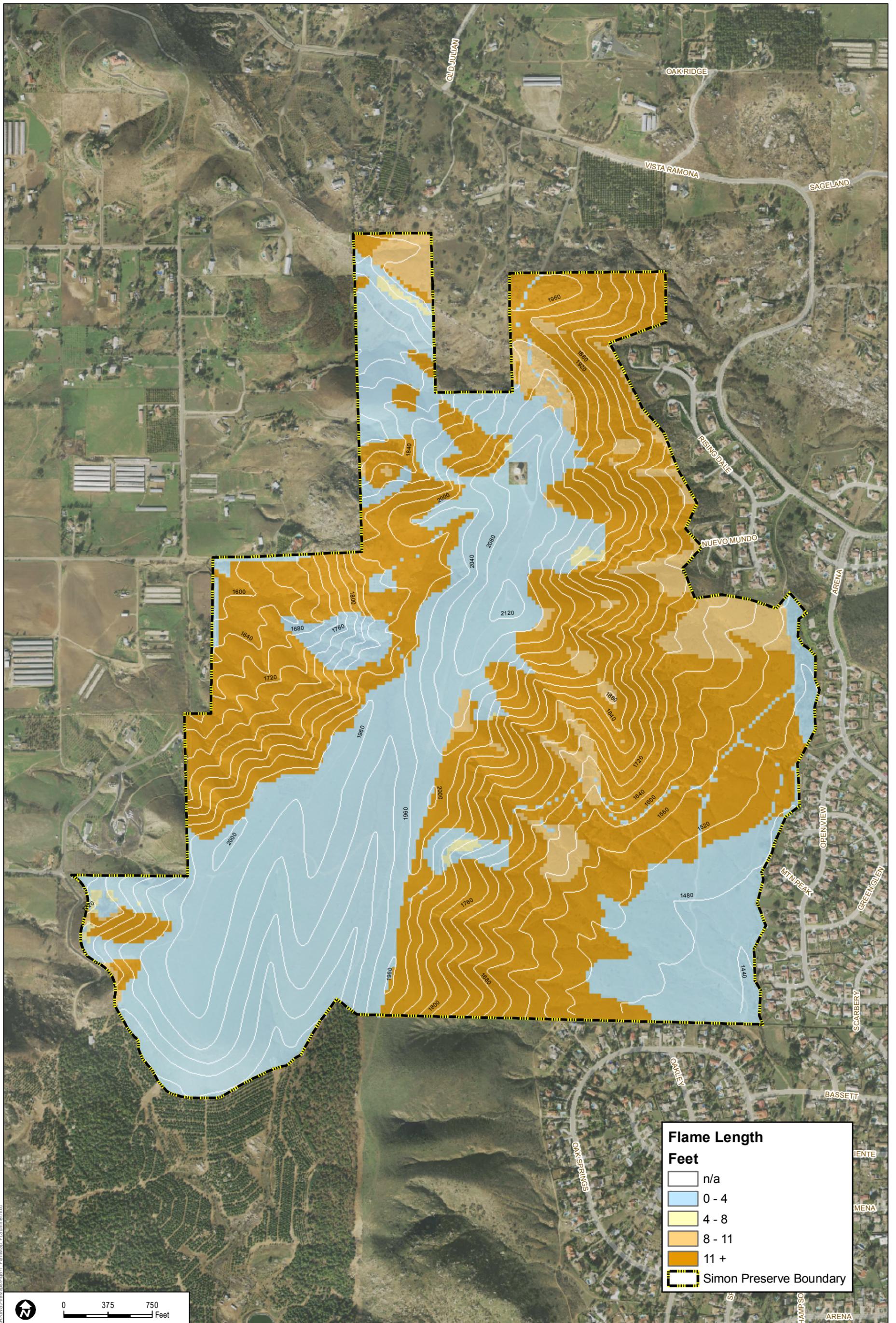
APPENDIX C (Continued)

FLAMMAP FUEL MODEL INPUTS

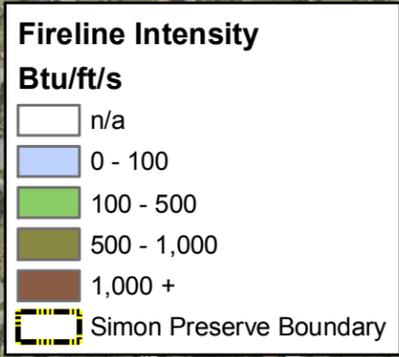
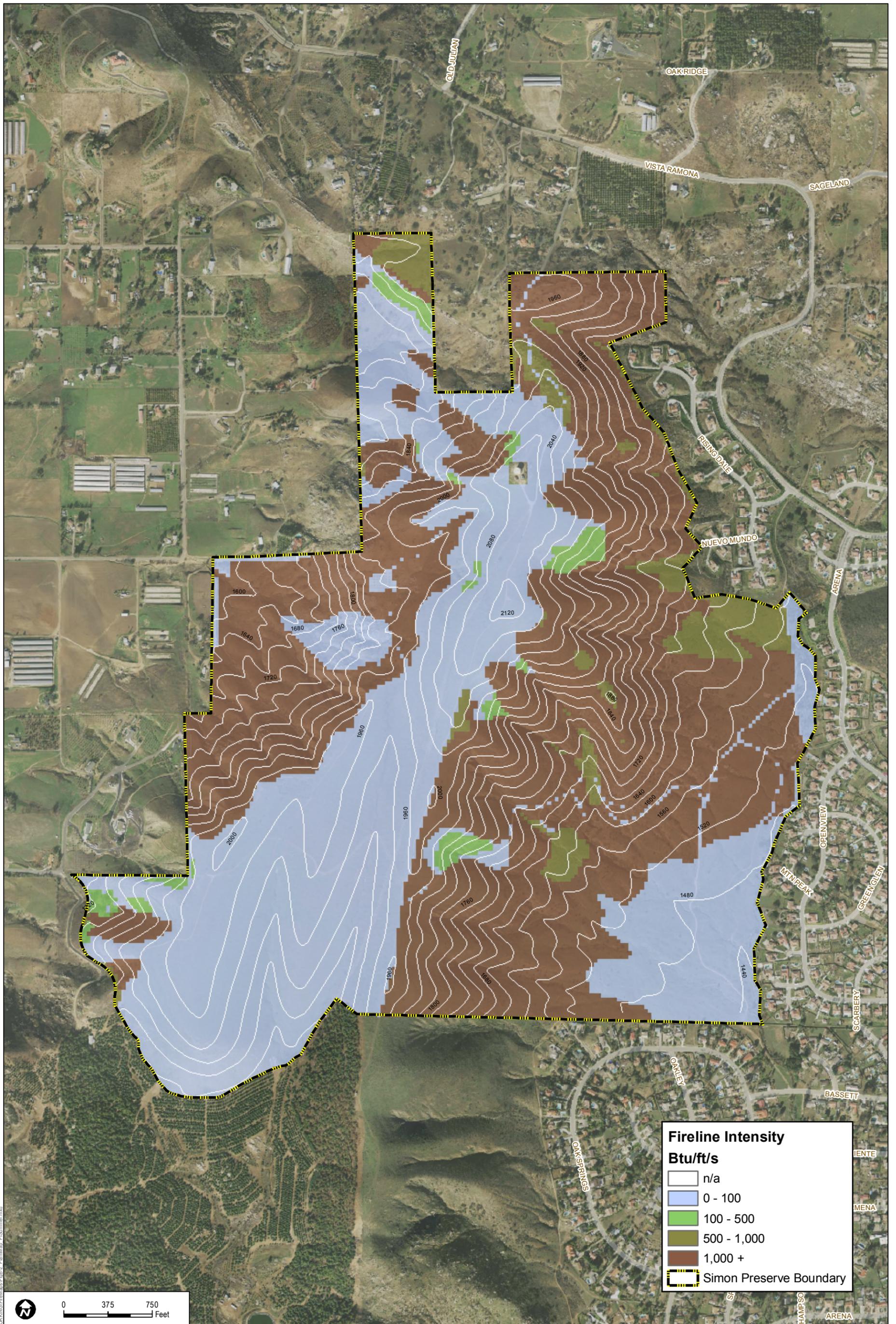
FlamMap software requires a minimum of 5 input files that represent field conditions in the study area, including elevation, slope, aspect, fuel model, and canopy cover. Each of these files was created as a raster geographic information system (GIS) file in Arc View 9.3.1 software, exported as an ASCII grid file, then utilized in creating a FARSITE Landscape file that served as the base for the FlamMap runs. The resolution of each grid file and associated ASCII file that was used in the models described herein is 10 meters, based on available digital elevation models (DEMs). In addition to the Landscape file, wind and weather data are incorporated into the model inputs. The output files chosen for each of the modeling runs included flame length (feet) and fireline intensity (BTU/ft/sec). Figures C-1 through C-4 depict the results of each of the four modeling runs and exhibit each of these output variables.

The following provides a description of the input and output variables used in processing the FlamMap models. In addition, data sources are cited and any assumptions made during the modeling process are described.

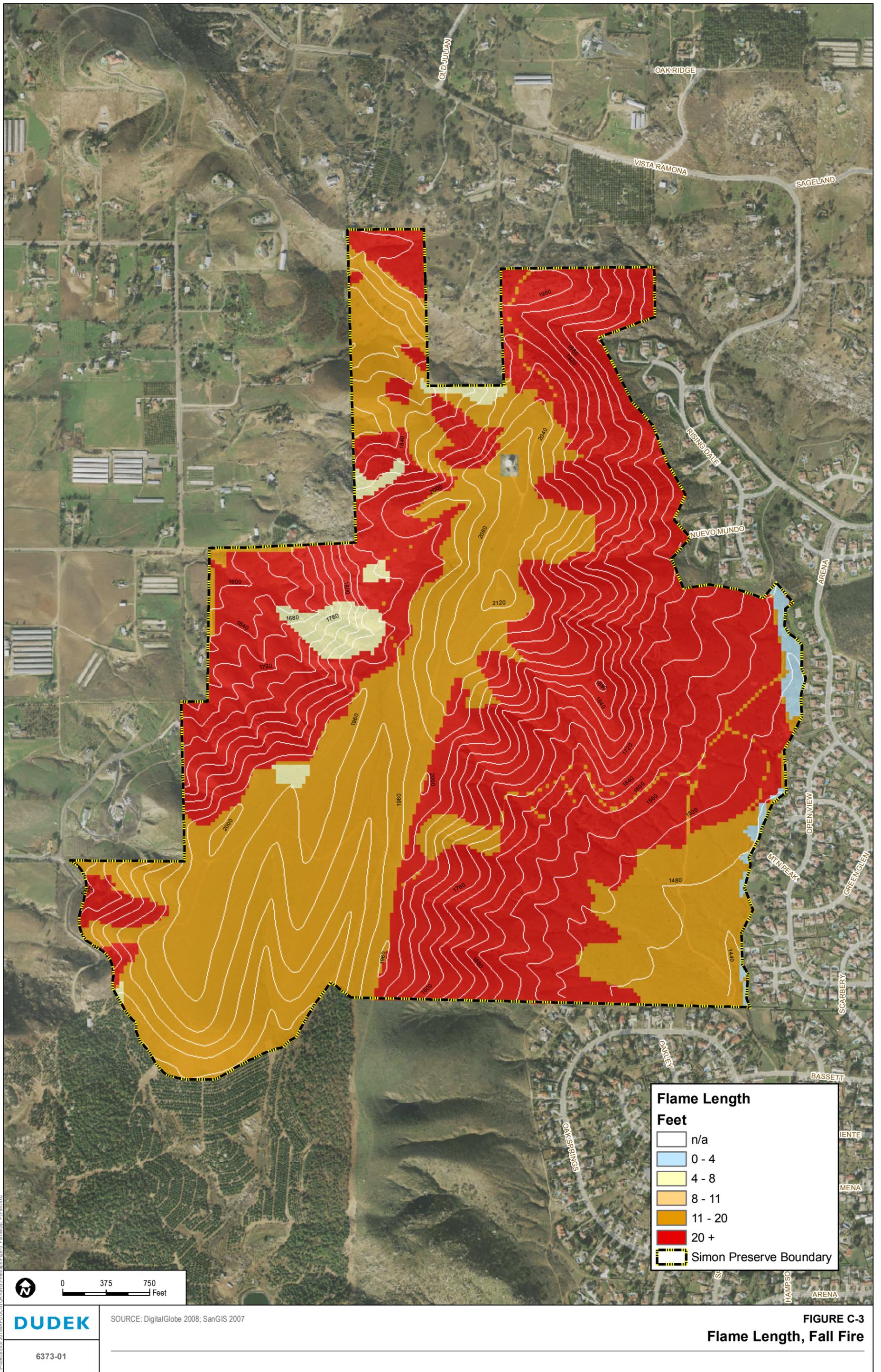
1. **Elevation.** Elevation data were derived from a 3 meter resolution DEM file that was acquired from the U.S. Geological Survey (USGS). This data were utilized to create an elevation grid file, using units of feet above mean sea level. The elevation data are a necessary input file for FlamMap runs and are necessary for adiabatic (i.e., a process that happens without loss or gain of heat) adjustment of temperature and humidity and for conversion of fire spread between horizontal and slope distances (Finney 2004).
2. **Slope.** Using Spatial Analyst tools, a slope grid file was generated from the elevation grid file. Slope measurements are represented in percent of inclination from horizontal. The slope input file is necessary for computing slope effects on fire spread and solar radiance (Finney 2004).
3. **Aspect.** Using Spatial Analyst tools, an aspect grid file was generated from the elevation grid. Aspect values are presented in azimuth degrees and are important in determining solar exposure.
4. **Fuel Model.** Vegetation coverage data in the form of a GIS shapefile were used in this analysis to create a fuel model file. Derived from the Dudek (2009) vegetation mapping data, the vegetation types were classified according to existing National Forest Fire Laboratory (NFFL) and BehavePlus fuel models, and the data file was converted to a grid file for inclusion in FlamMap modeling. Table 1 presents the vegetation and associated fuel type classifications for the Preserve.
5. **Canopy Cover.** Canopy cover is a required file for FlamMap operations. It is necessary for computing shading and wind reduction factors for all fuel models.



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Flame Length	
Feet	
[White Box]	n/a
[Light Blue Box]	0 - 4
[Yellow Box]	4 - 8
[Orange Box]	8 - 11
[Dark Orange Box]	11 - 20
[Red Box]	20 +
[Dashed Yellow/Black Line]	Simon Preserve Boundary

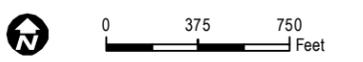


FIGURE C-3
Flame Length, Fall Fire

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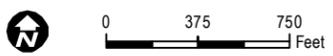
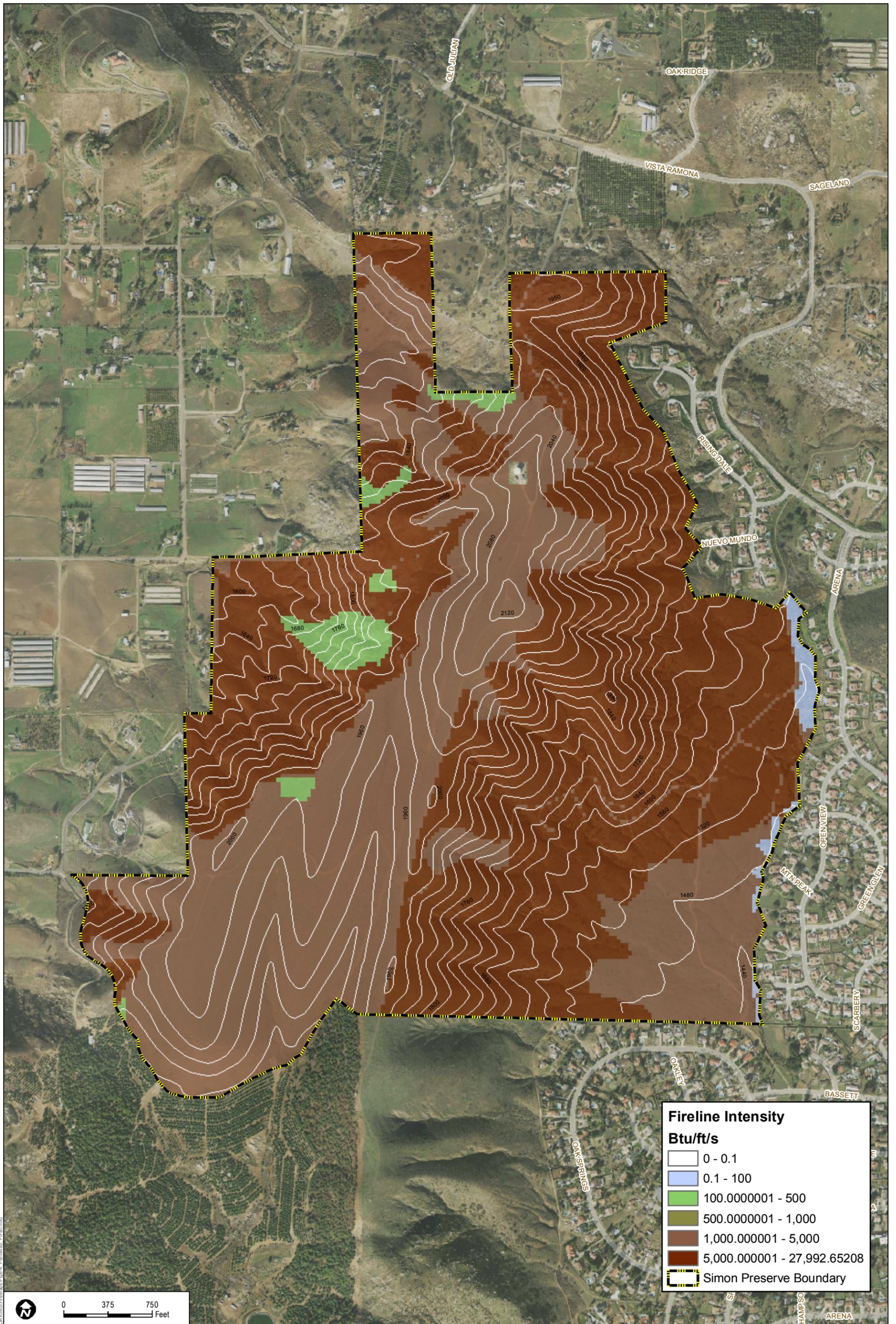


FIGURE C-4
Fireline Intensity, Fall Fire

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APPENDIX C (Continued)

Canopy cover is the horizontal percentage of the ground surface that is covered by tree crowns. Canopy cover is measured as the horizontal fraction of the ground that is covered directly overhead by tree canopy. Crown closure refers to the ecological condition of relative tree crown density. Stands can be said to be "closed" to recruitment of canopy trees but still only have 40% or 50% canopy cover (Finney 2004). Coverage units can be categories (0–4) or percentage values (0–100). Table 2 presents canopy cover assignments for each vegetation type/fuel model

Table 2
Fuel Models and Associated Canopy Cover Values

Vegetation Community/Land Cover	Fuel Model	Canopy Cover Value
Disturbed Habitat	1	0
Orchard	9	3
Diegan Coastal Sage Scrub	SCAL18	0
Disturbed Diegan Coastal Sage Scrub	SCAL18	0
Chamise Chaparral	SH7	0
Coastal Sage Scrub – Southern Mixed Chaparral	SH7	0
Disturbed Coastal Sage Scrub – Southern Mixed Chaparral	SH7	0
Southern Mixed Chaparral	SH7	0
Non-native Grassland	1	0
Oak Riparian Forest	8	3
Southern Cottonwood – Willow Riparian Forest	8	3
Southern Riparian Woodland	8	3
Southern Willow Scrub	8	3
Arrowweed Scrub	SCAL18	0
Coast Live Oak Woodland	9	3
Engelmann Oak Woodland	9	3
Eucalyptus Woodland	TU5	3
Developed	0	0

Weather

Wind and weather data are also a required component to fire behavior modeling efforts. Data for the Preserve was obtained from the Goose Valley RAWS and included fuel moisture and wind speed data covering a period of 27 years. This information was processed with the FireFamily Plus software package to determine summer (50th percentile) and fall (97th percentile) weather conditions to be incorporated into the Initial Fuel Moisture file used as an input in FlamMap. Wind direction and wind speed values for the two FlamMap runs were manually entered during the data input phase. All other weather data were held constant for each of the FlamMap runs. Table 3 summarizes weather and fuel moisture data inputs used for both summer and fall weather conditions.

APPENDIX C (Continued)

Table 3
FlamMap Weather Input Variables

Model Variable	50th Percentile Weather	97th Percentile Weather (w/ Max. Wind)
1 h fuel moisture	5%	2%
10 h fuel moisture	7%	3%
100 h fuel moisture	14%	8%
Live herbaceous moisture	65%	30%
Live woody moisture	114%	50%
20 ft wind speed (mph)	7 mph	50 mph (maximum observed Fall wind speed)
Wind direction	Up-slope	Up-slope
Slope steepness	Variable by location	Variable by location

mph = miles per hour

FlamMap Fuel Model Outputs

Two output grid files were generated for each of the two FlamMap runs, and include representations of flame length (feet) and fireline intensity (BTU/feet/second), as shown in Figures C-1 through C-4. The aforementioned fire behavior variables are an important component in understanding fire risk and fire agency response capabilities. Flame length, the length of the flame of a spreading surface fire within the flaming front, is measured from midway in the active flaming combustion zone to the average tip of the flames (Andrews, Bevins, and Seli 2004). It is a somewhat subjective and non-scientific measure of fire behavior, but is extremely important to fireline personnel in evaluating fireline intensity and is worth considering as an important fire variable (Rothermel 1991). Fireline intensity is a measure of heat output from the flaming front, and also affects the potential for a surface fire to transition to a crown fire and is another important variable in initial attack and fire suppression efforts. The information in Table 4 presents an interpretation of these fire behavior variables as related to fire suppression efforts.

Table 4
Fire Suppression Interpretation

Flame Length (feet)	Fireline Intensity (Btu/ft/s)	Interpretations
Under 4	Under 100	Fires can generally be attacked at the head or flanks by persons using hand tools. Hand line should hold the fire.
4 to 8	100 to 500	Fires are too intense for direct attack on the head by persons using hand tools. Hand line cannot be relied on to hold the fire. Equipment such as dozers, pumpers, and retardant aircraft can be effective.
8 to 11	500 to 1000	Fires may present serious control problems—torching out, crowning, and spotting. Control efforts at the fire head will probably be ineffective.
Over 11	Over 1000	Crowning, spotting, and major fire runs are probable. Control efforts at head of fire are ineffective.

APPENDIX C (Continued)

Source: BehavePlus 3.0.2 fire behavior modeling program (Andrews, Bevins, and Seli 2004)

The fire behavior analysis results for the Preserve vary depending on fuel type. As FlamMap utilizes site-specific digital terrain data (including slope, vegetation, aspect, and elevation data) slight variations in predicted flame length and fireline intensity values can be observed based on fluctuations of these attributes across the landscape. As presented, wildfire behavior in each of the fuel types varies depending on weather conditions. Given the climatic, vegetation, and topographic characteristics along with the fire history and fire behavior modeling results discussed in this Vegetation Management Plan (VMP), the Preserve is determined to be vulnerable to wildfire starting in, burning onto, or spotting onto the site. Based on this information, adjacent residential development, and the fire history of the area, it is expected that wildfires will occur on the Preserve in the future.

Under extreme fall weather conditions (97th percentile fuel moistures and maximum recorded wind speeds of 50 miles per hour), fire can move rapidly through the site's fuels. Worst-case flame lengths were calculated at approximately 49 feet in chaparral vegetation types and approximately 42 feet in sage scrub vegetation on slopes exceeding 40% in the western portion of the property. Spread rates on site may exceed 6 miles per hour in dry flashy fuels (grasses and scrub) under extreme weather and slope conditions. Finally, under extreme weather and wind conditions, fireline intensity values may exceed 1,000 Btu/feet/second limiting the options for fire response personnel and emphasizing the importance of fuel modification and defensible space for the planned community.

It should be noted that the modeling results depict values based on inputs to the FlamMap system. Variations in weather or pockets of different fuel types are not accounted for in this analysis. Additionally, the scale of analysis (3 square meters) limits fine-scale analysis and interpretation. Model results should be used as a basis for planning only, as actual fire behavior for a given location will be affected by many factors, including unique weather patterns, small-scale topographic variations, or changing vegetation patterns that could not be obtained for this analysis.

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