United States
Department of
Agriculture
Forest Service

United States
Department of
Interior Bureau of
Land Management

Nevada Division of
Forestry

Nevada Division of
State Lands

Nevada Fire Safe
Council

Clark County Fire
Department

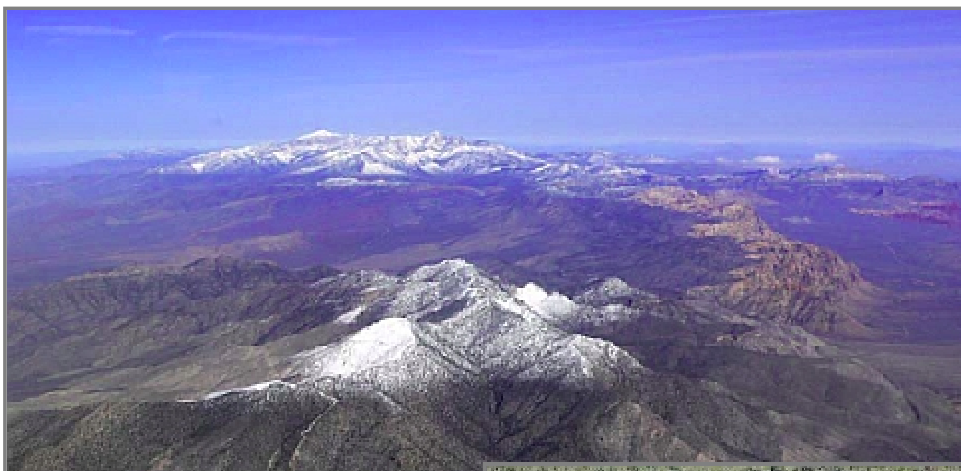
Nye County Fire
Department

Pahrump Valley Fire
Department

Spring Mountains

Multi-Jurisdictional Fuel Reduction and Wildfire Prevention Strategy

September 2008 Draft



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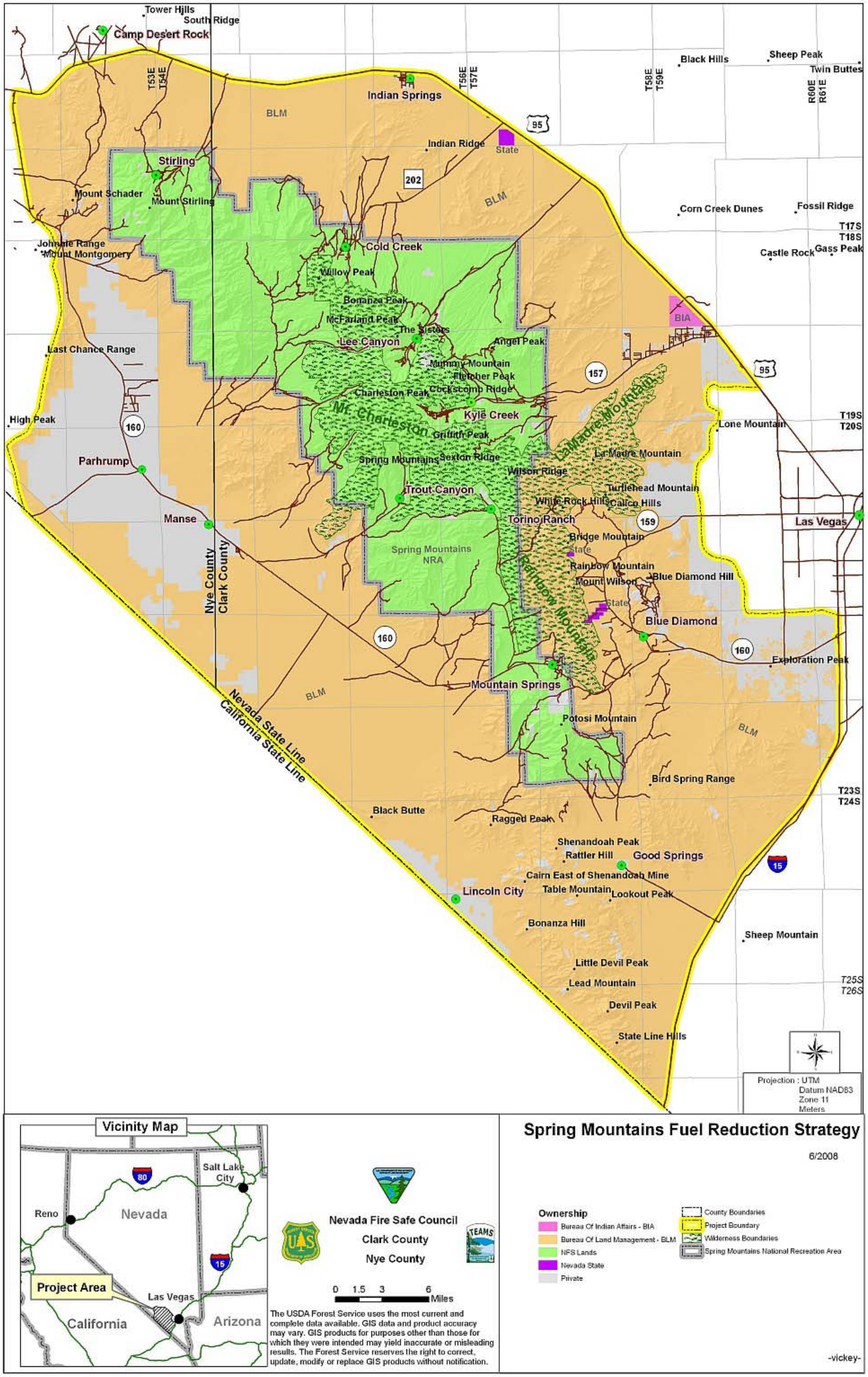


Figure 1. Spring Mountains strategic planning area

Section 1: Introduction

Purpose of this Plan

This comprehensive fuels reduction and wildfire prevention plan is a unified, multi-jurisdictional strategic synopsis of the planning efforts of local, county, state, and federal entities. The proposed projects in this plan provide a 10-year strategy to reduce the risk of large and destructive wildfire in the Spring Mountains planning area. The plan's outcome is to 1) propose projects that create "community defensible space", 2) comprehensively display all proposed fuel reduction treatments, and 3) facilitate communication and cooperation among those responsible for plan implementation. If implemented, this plan will provide greater protection to the people, infrastructure, and resources in the planning area.

This plan was developed to comply with the White Pine County Conservation, Recreation, and Development Act of 2006 (Public Law 109-432 [H.R.6111]), which amended the Southern Nevada Public Land Management Act of 1998 (Public Law 105-263) to include the following language:

> *"development and implementation of comprehensive, cost-effective, multi-jurisdictional hazardous fuels reduction and wildfire prevention plans (including sustainable biomass and biofuels energy development and production activities) for the Spring Mountains (to be developed in conjunction with the Tahoe Regional Planning Agency), the Spring Mountains in Douglas and Washoe Counties and Springs Mountain Comprehensive Plan City in the State, and the Spring Mountains in the State, that are*--
>
> *(I) subject to approval by the Secretary; and*
>
> *(II) not more than 10 years in duration"*

This *comprehensive* plan is supported by eight partners who each have a role in wildland fuels or fire management in the planning area (see "Agencies Involved" below). The proposed strategic treatments are *multi-jurisdictional,* occurring on federal, state, county, and private lands (Figure 1 shows plan area). The strategic treatments are *cost effective* because they are economical, based on the tangible benefits produced for the money spent (see "Proposed Project Costs", p. 22). "Cost effective" is defined here as targeted, priority-based fuel reduction treatments conducted at a reasonable cost that produce meaningful protection of life, property, and the environment within the operating guidelines defined by this plan. Finally, the plan details potential utilization strategies of vegetation removal products, including *biomass*, which could occur when the plan is implemented (see "Utilization Potential", p. 27).

Agencies Involved or Consulted

This plan was developed by the following cooperators:

- Nevada Division of Forestry
- Nevada Division of State Lands
- Nevada Fire Safe Council
- Clark County Fire
- Nye County Fire
- Bureau of Land Management, Las Vegas Field Office
- USDA Forest Service, Humboldt-Toiyabe National Forest, Spring Mountains National Recreation Area

Collaborative Process

The USDA Forest Service, Humboldt-Toiyabe National Forest, Spring Mountains National Recreation Area assumed the lead role in coordinating the development of this plan. The Forest recruited a cadre of representatives (planning cadre) from fire districts and land management and regulatory agencies (see "Planning Cadre Members") to function as a plan work group. The group met for more than 6 months throughout 2008. Members of this group and agency level fire and fuels specialists formed a planning group (Springs Mountain Comprehensive Plan Fuels Analysis Team) that developed the proposed projects and supporting analysis. Subsequent review and coordination of the plan occurred after those meetings. Participants reviewed and discussed the White Pine legislation, and agreed on a plan outline that would best address the requirements of the bill. Work group representatives served as points of contact for their respective groups or agencies, and provided information used in the development of this plan.

Roles and Responsibilities

The roles and responsibilities of individuals and agencies involved with wildland fire management and prevention in the planning area are summarized in Table 1. All individual landowners and most agencies have land management responsibilities. This includes identifying concerns on parcels under their ownership or administration, and recommending and implementing actions that remedy those concerns.

Table 1. Summary of roles and responsibilities of agencies and individuals to implement the strategy

Agency/Land	**Land Management**	**Regulatory**	**Lead Agency for Environmental Compliance**	**Funding**	**Programmatic Oversight**
Nevada Fire Safe Council representing private landowners: •Kyle Canyon Community Fire Safe Chapter •Mountain Springs Fire Safe Chapter •Cold Creek Community Fire Safe Chapter •Trout Canyon Fire Safe Chapter				X	X
USDA Forest Service, Humboldt-Toiyabe National Forest Spring Mountains National Recreation Area	X	X	X	X	X
USDI Bureau Of Land Management, Las Vegas Field Office	X	X	X	X	X
Nevada Division of Forestry	X	X	X	X	X
Clark County Fire		X	X	X	X
Nye County Fire		X	X	X	X
Fire Protection Districts Mount Charleston Fire		X		X	X

Section 2: Wildland Fuel Reduction Projects

The planning cadre reviewed all past and currently proposed fuel reduction projects. After reviewing these, and comparing the landscape to current fire risk models, additional treatments were proposed in a comprehensive manner. These proposed treatments were prioritized into an implementation schedule. Since this plan is strategic, a majority of projects will require site-specific design and planning, which may result in final projects that vary in size, location, and scheduling as compared to this plan. Coordination between agencies as to the implementation and prioritization of projects in the community wildfire protection plans, to which this plan is tiered, is critical to the overall success of this comprehensive plan.

Current Accomplishments

Elected officials and agencies have recognized the need to reduce hazardous fuels and restore forest health on National Forest, State of Nevada, tribal, county, and private lands. Several key steps have been taken to address that need. Four local Fire Safe Council chapters have been established within the project area. These local chapters are community-based organizations where local residents actively engage in obtaining political and financial support to create defensible space and accomplish projects around their communities. Community wildfire protection plans have been prepared for the communities and approved by local and state agencies in many of the communities that are within the Spring Mountains (Figure 2).

All of the land management agencies and most of the local fire agencies have been actively treating hazardous fuels within the Spring Mountains for some time. Currently, more than 4,000 acres of proposed fuel reduction projects have been accomplished or are planned and being implemented. These existing projects were reviewed and considered in this strategy. The strategy looked at ways to build greater connectivity and protection for at-risk resources building upon these existing projects (Figure 3).

Proposed Projects

Representatives from the USDA Forest Service, USDI Bureau of Land Management, Nevada Division of Forestry, Clark County Fire, Nye County Fire and the Nevada Fire Safe Council consolidated and prioritize fuels treatment projects for protecting life and property, modifying fire behavior on a landscape level, and improving forest health. The projects were delineated by jurisdiction and ownership. Proposed projects involve treatments of 88,090 acres of private, county, and federal lands (Figure 4).

Proposed treatments were also prioritized and assigned an accomplishment interval. The accomplishment intervals are within 0 to 5 years and from 5 to 10 years. Figures 5, 6, 7, 8, 9, and 10 display proposed treatment units by 5-year intervals.

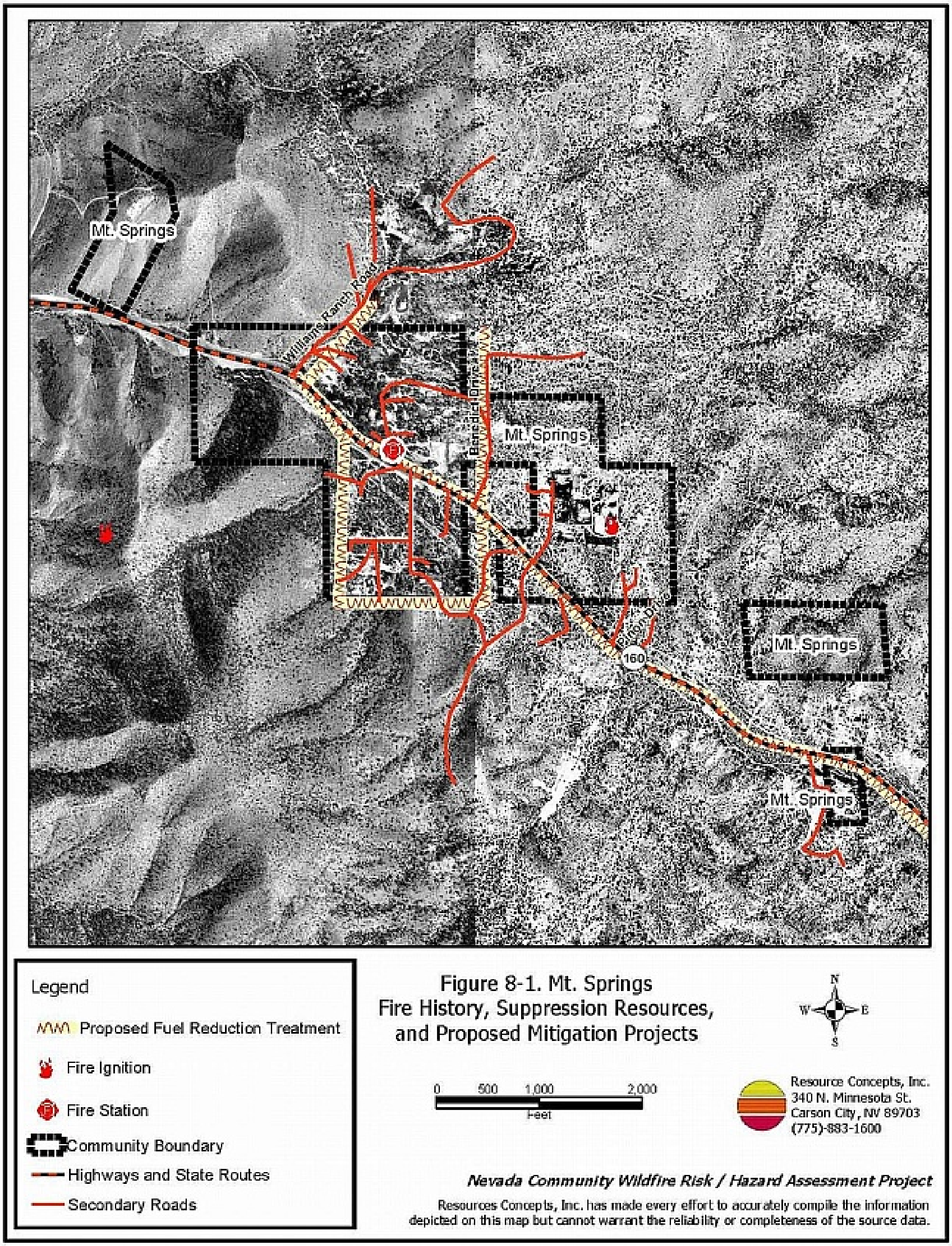


Figure 2. Example map from a community wildfire protection plan incorporated in this plan

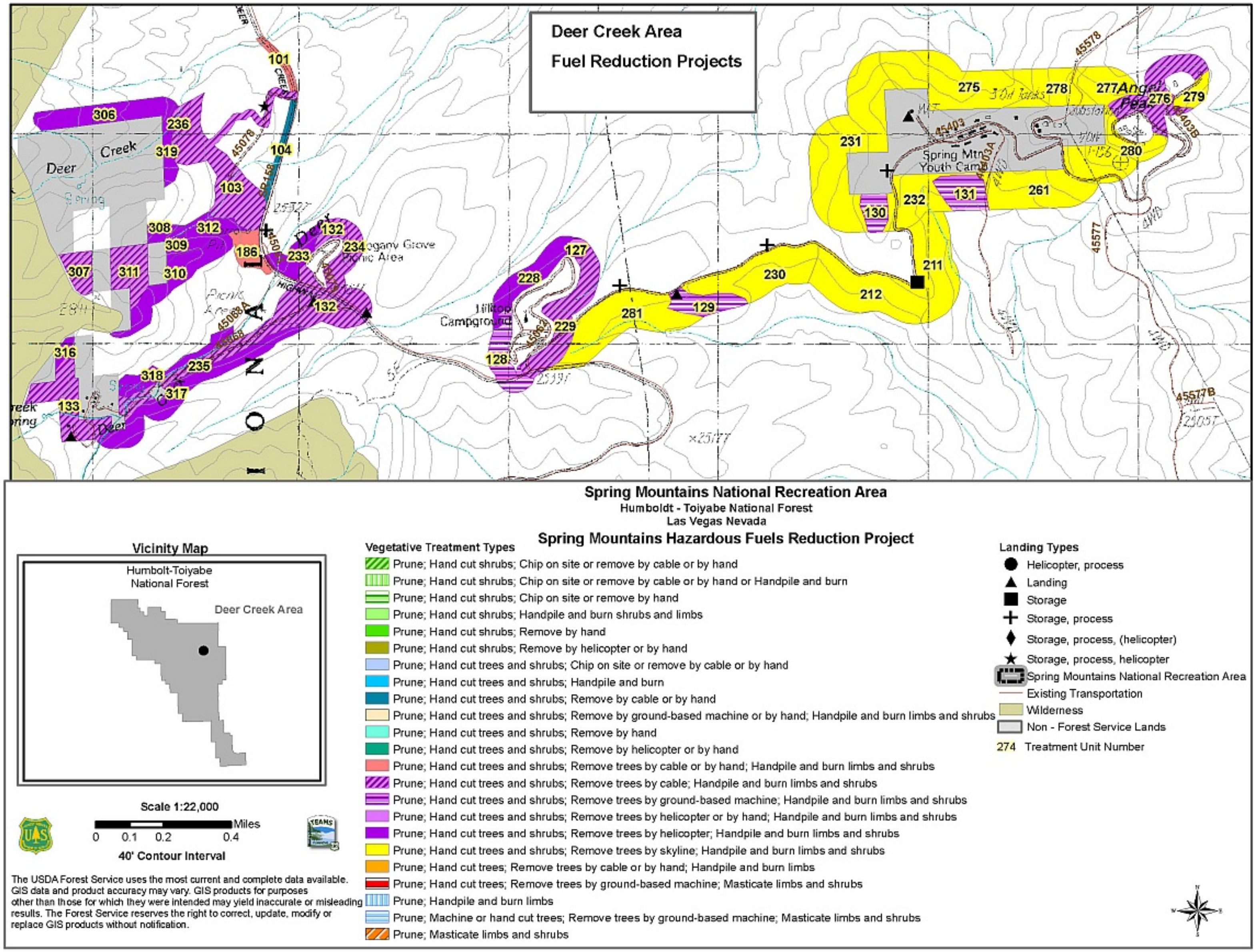
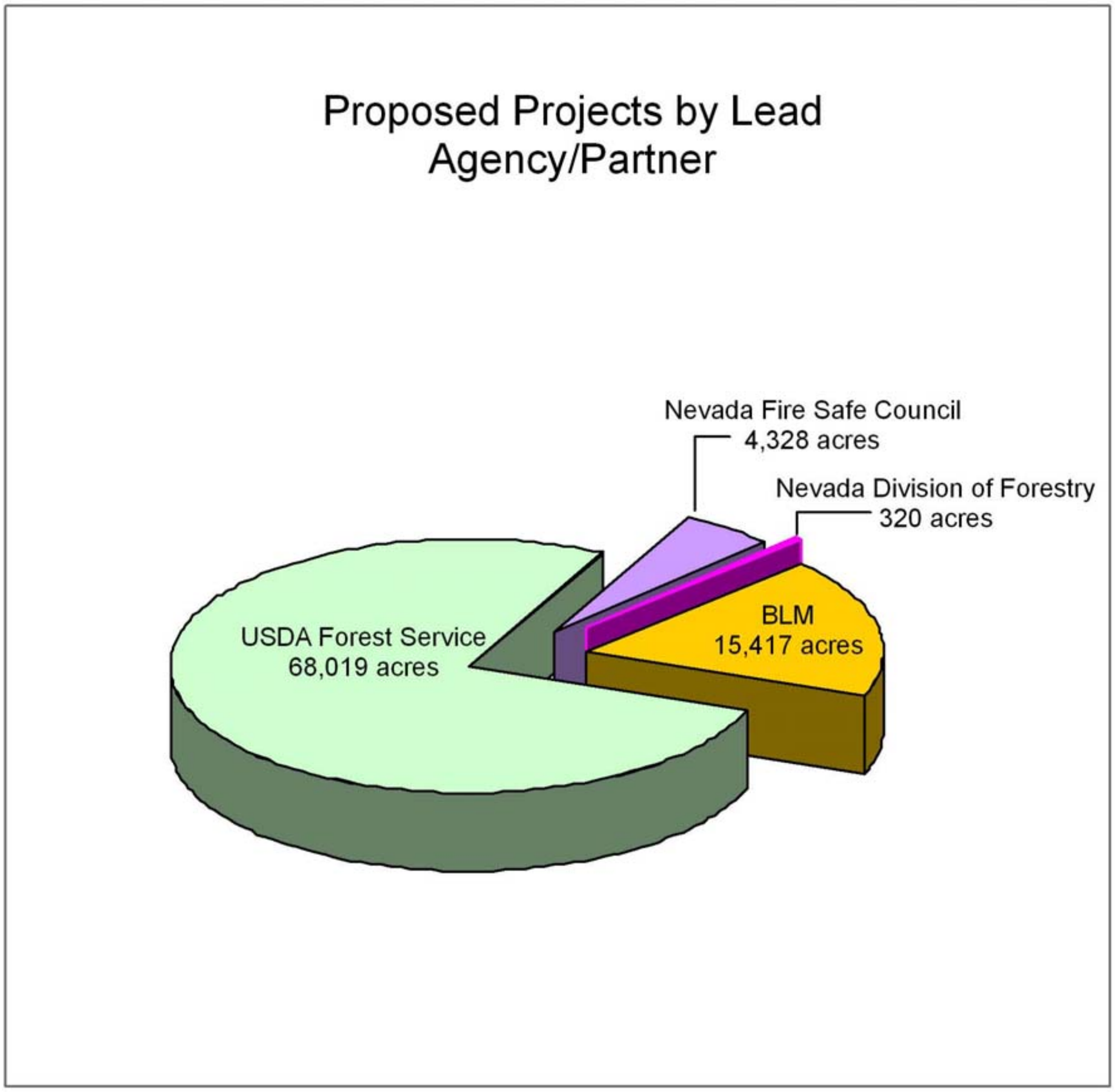


Figure 3. Example of current fuel reduction projects occurring in the Spring Mountains



Treatment Period	USDA Forest Service	Nevada Fire Safe Council	Nevada Division of Forestry	BLM	Total Acres
0-5 Years	14,240	3,850	320	11,065	29,475
5-10 Years	53,779	478	0	4,353	58,610
Total Acres	68,019	4,328	320	15,417	88,085

Figure 4. Percent and acres of proposed projects lead by each jurisdiction

Prescriptions and Treatment Methodologies

In all proposed projects, vegetation structure and composition will be modified to reduce fire behavior (see "Desired Conditions"). Site-specific *prescriptions* that explicitly define what vegetation would be removed in the project and how it would be accomplished would be developed for each project. General prescriptions and treatment methodologies are described in the subsequent sections.

Prescriptions

Prescriptions would vary with location, vegetation type, and objectives, and in most cases, would require a combination of treatments. The primary treatment objective for all projects focuses on the protection of life and property within the wildland-urban interface (Figure 11). However, for some treatment areas, additional objectives including improving forest health, creating and maintaining fire-resilient ecosystems, and modifying fire behavior on the landscape level have been identified or would be identified during project planning. Generally, prescriptions will be developed to reduce surface, ladder, and crown fuels, with the objective of altering predicted fire behavior and severity.

Community Wildfire Protection Plan WUI Prescriptions

Resource Concepts, Inc. (RCI), a Carson City consulting firm conducted Community Risk/Hazard Assessments of all the communities within the analysis area in 2005. The RCI Project Team assessed both the risk of ignition and the potential fire behavior hazard within the wildland-urban interface, places where homes and wildland meet. This was a collaborative planning effort in which numerous agencies and individuals were involved. Included in this collaborative effort were the Nevada Fire Safe Council (NFSC), Bureau of Land Management (BLM), U.S. Forest Service (USFS), Nevada Division of Forestry (NDF), Nye County Fire, and Clark County Fire. From that effort, the Wildland Assessment Project was completed, becoming a community wildfire protection plan (CWPP). The CWPP (administered by Nevada Fire Safe Council through National Fire Plan funding) recommended a series of projects to protect communities from wildfire in Clark County and Nye County. This proposal contains those recommendations and other proposals that accomplish the goals of the CWPP, National Fire Plan, and agency direction for the analysis area. General prescriptions for each project were identified describing vegetation that should be removed to achieve the desired conditions. Recognizing that each agency will develop its own prescriptions, guidelines for development of prescriptions were identified in the CWPP. These guidelines focused on vegetation and fuel management in the defense zone and threat zone.

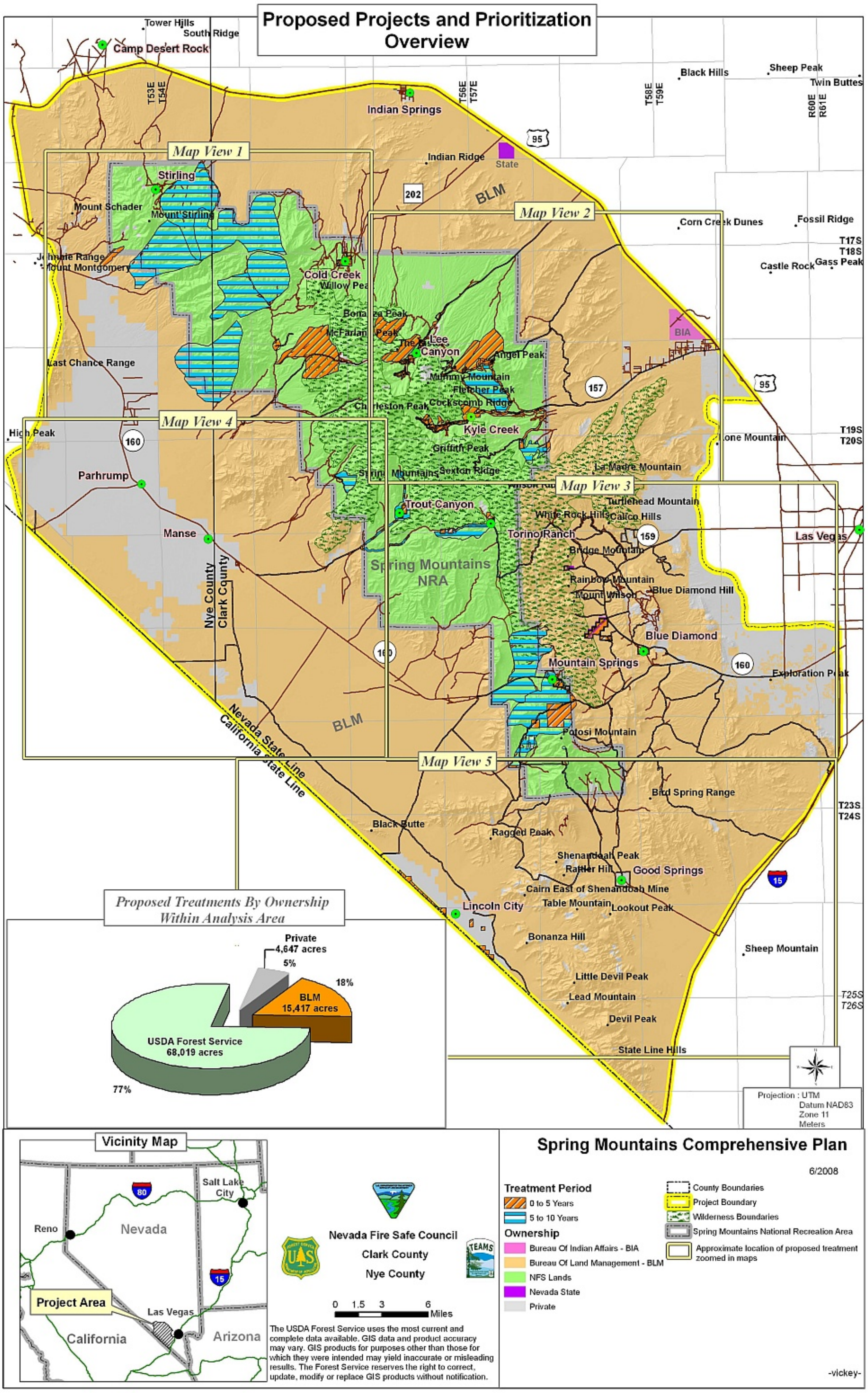


Figure 5. Proposed projects and prioritization overview

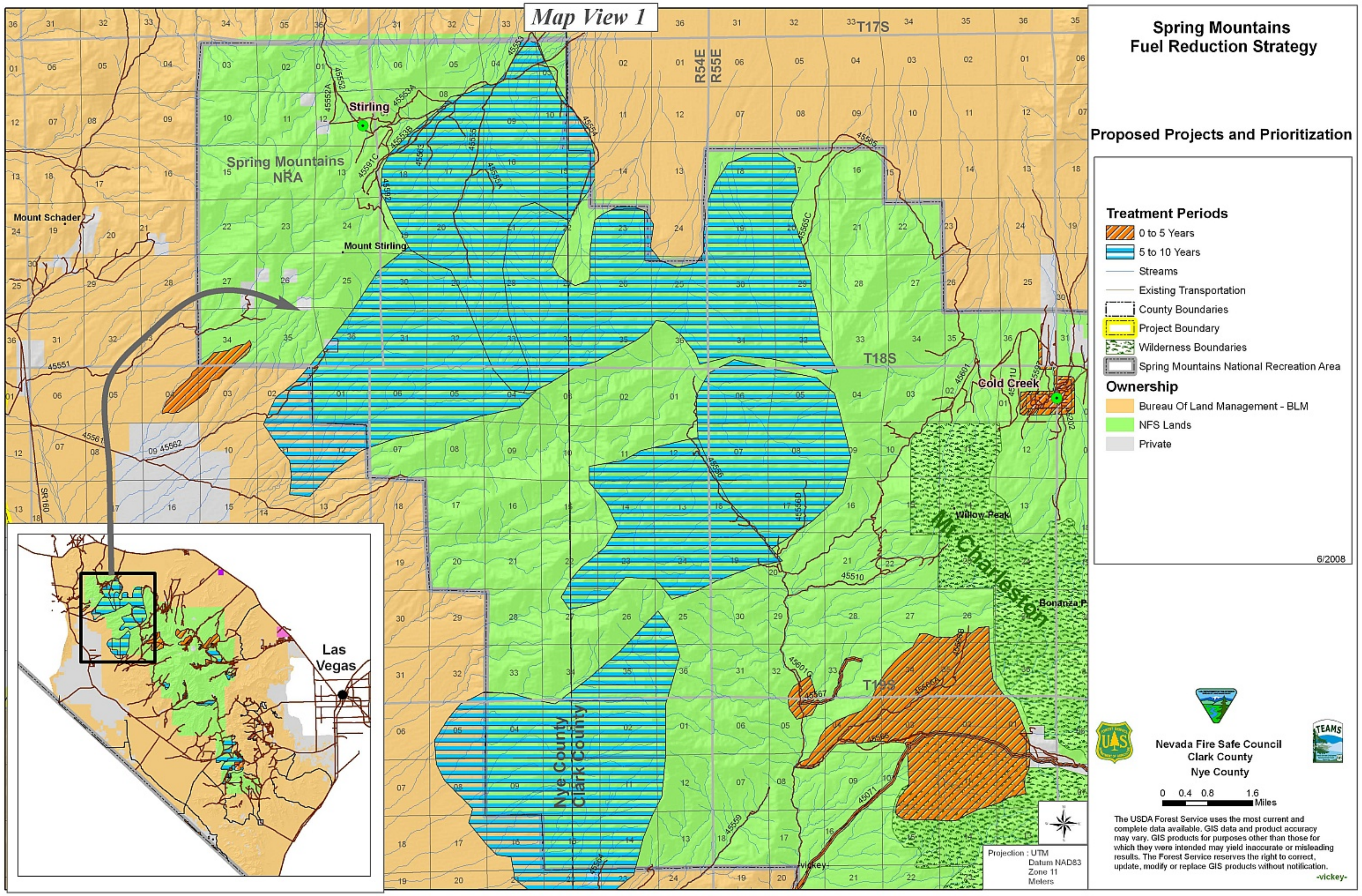


Figure 6. Proposed projects, northwest portion of the analysis area

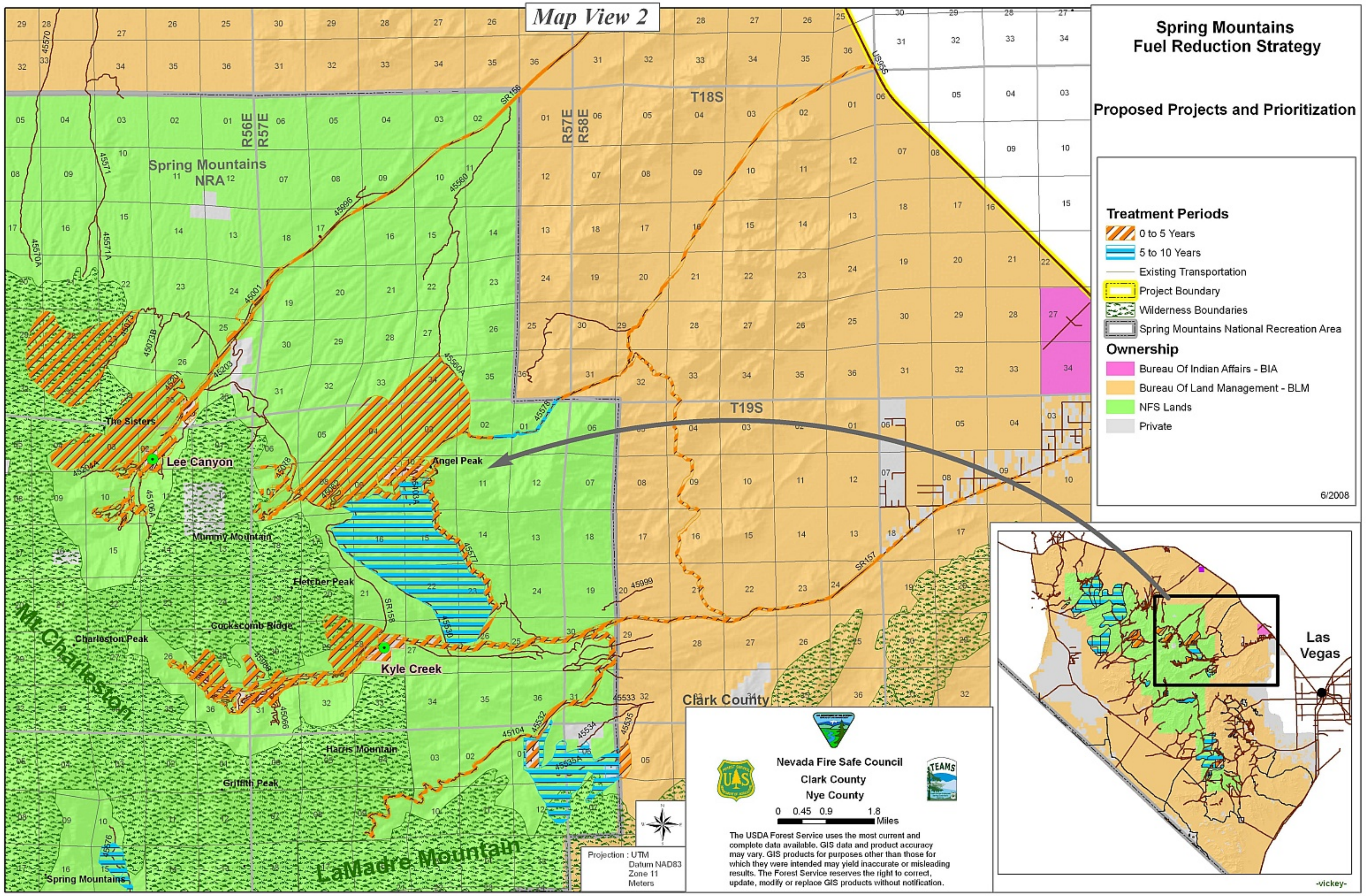


Figure 7. Proposed projects, east-central portion of the analysis area

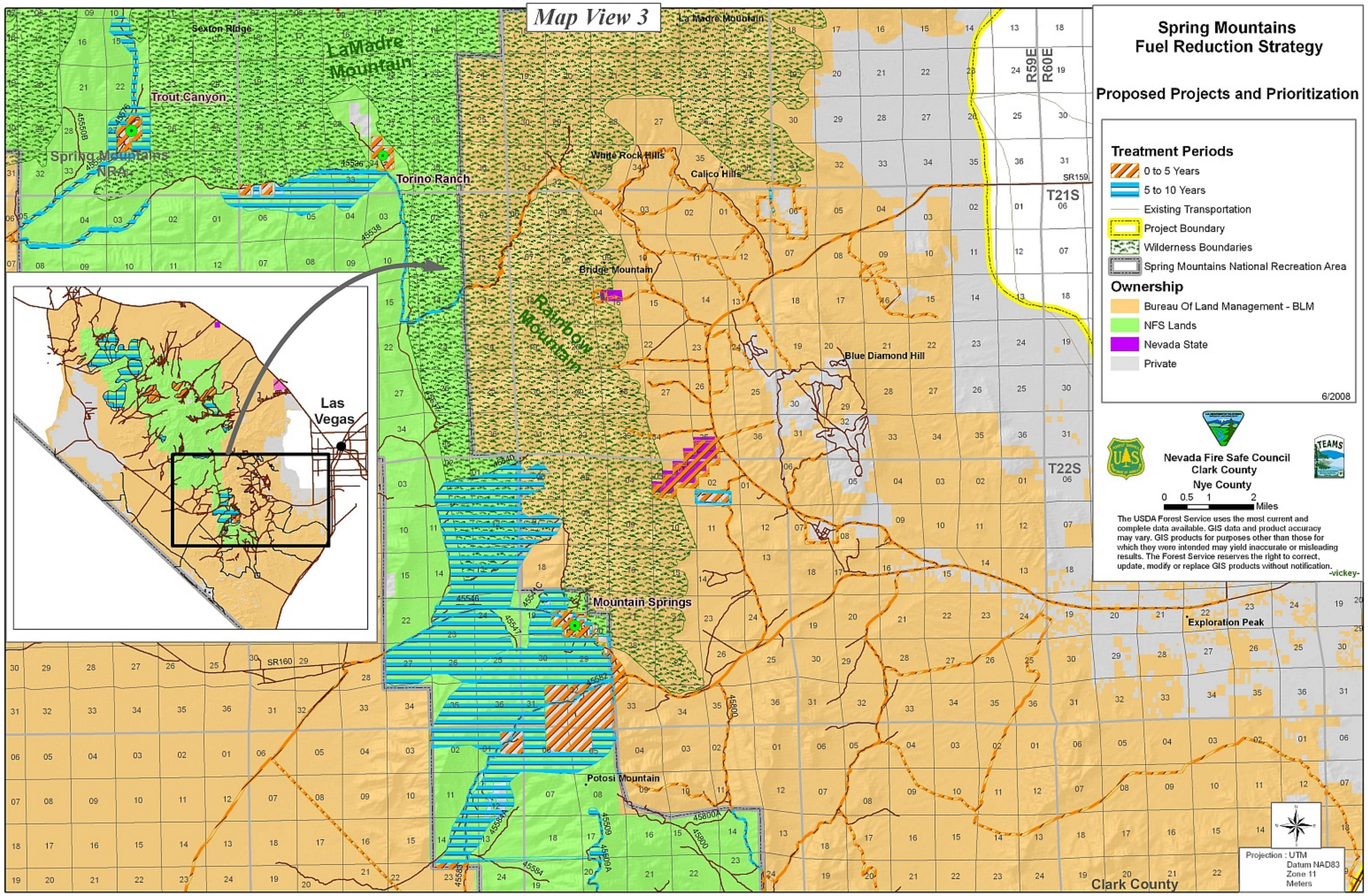


Figure 8. Proposed projects, southeast portion of the analysis area

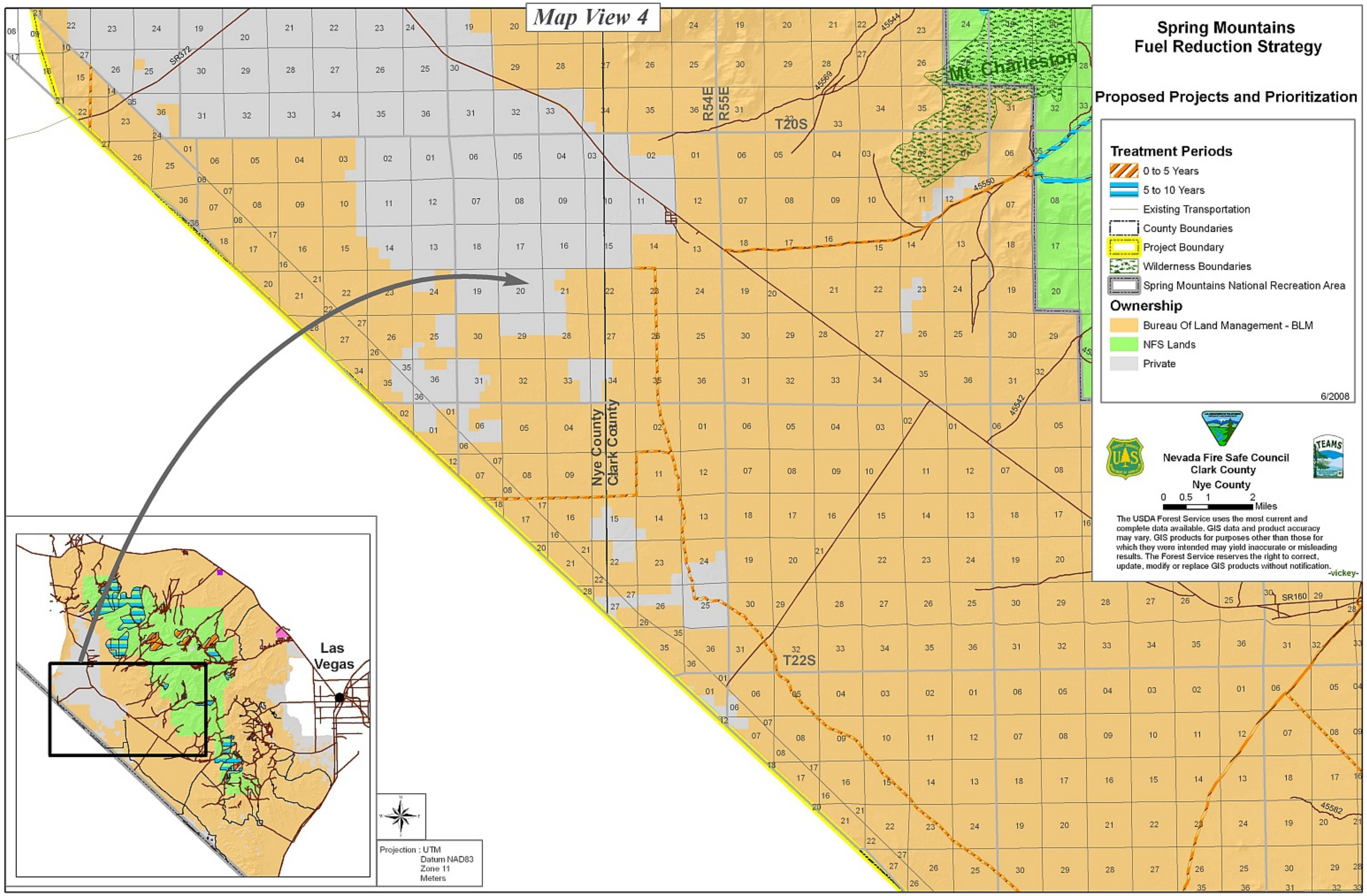


Figure 9. Proposed projects, southwest portion of the analysis area

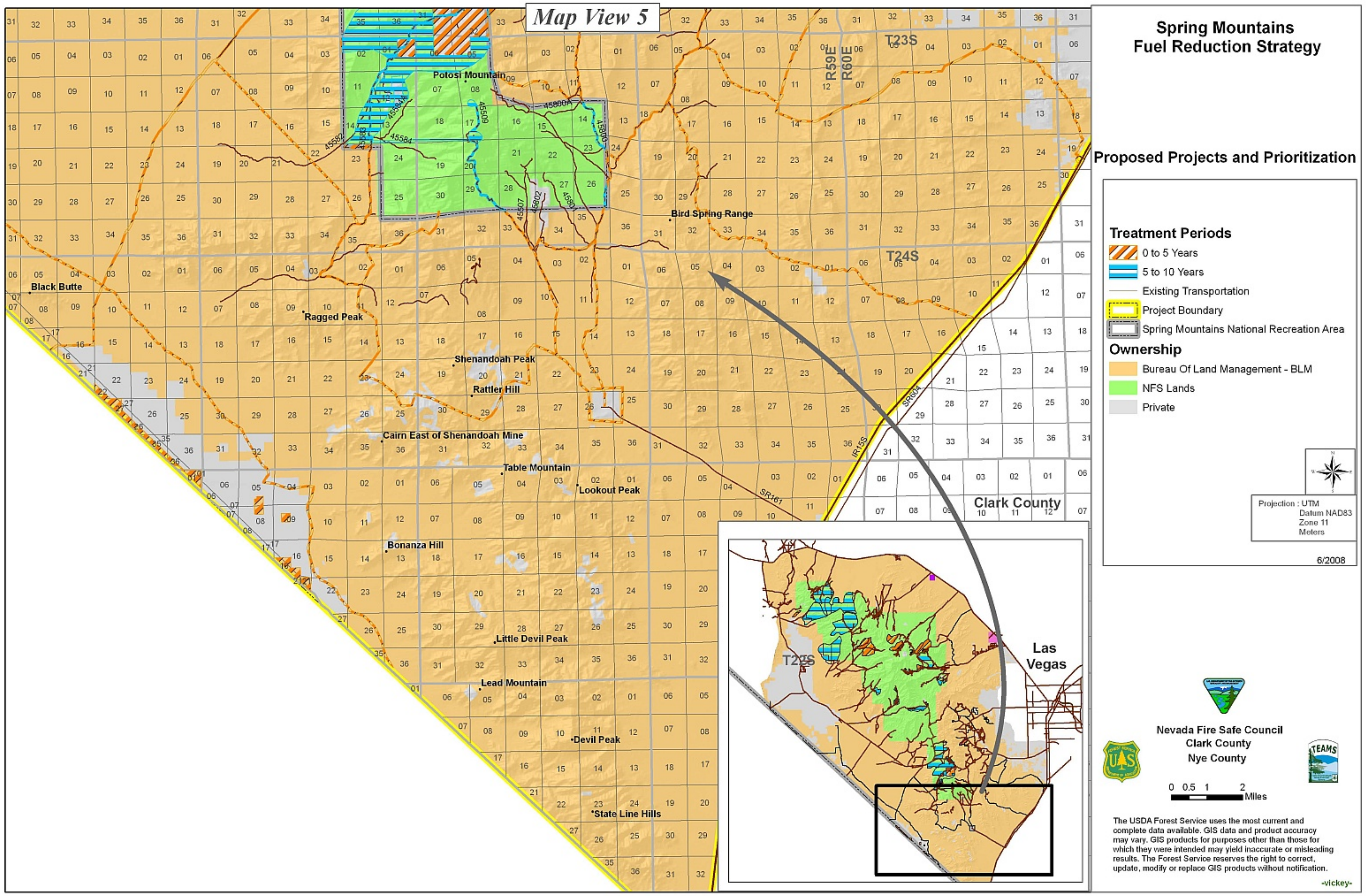


Figure 10. Proposed projects, south end of the analysis area

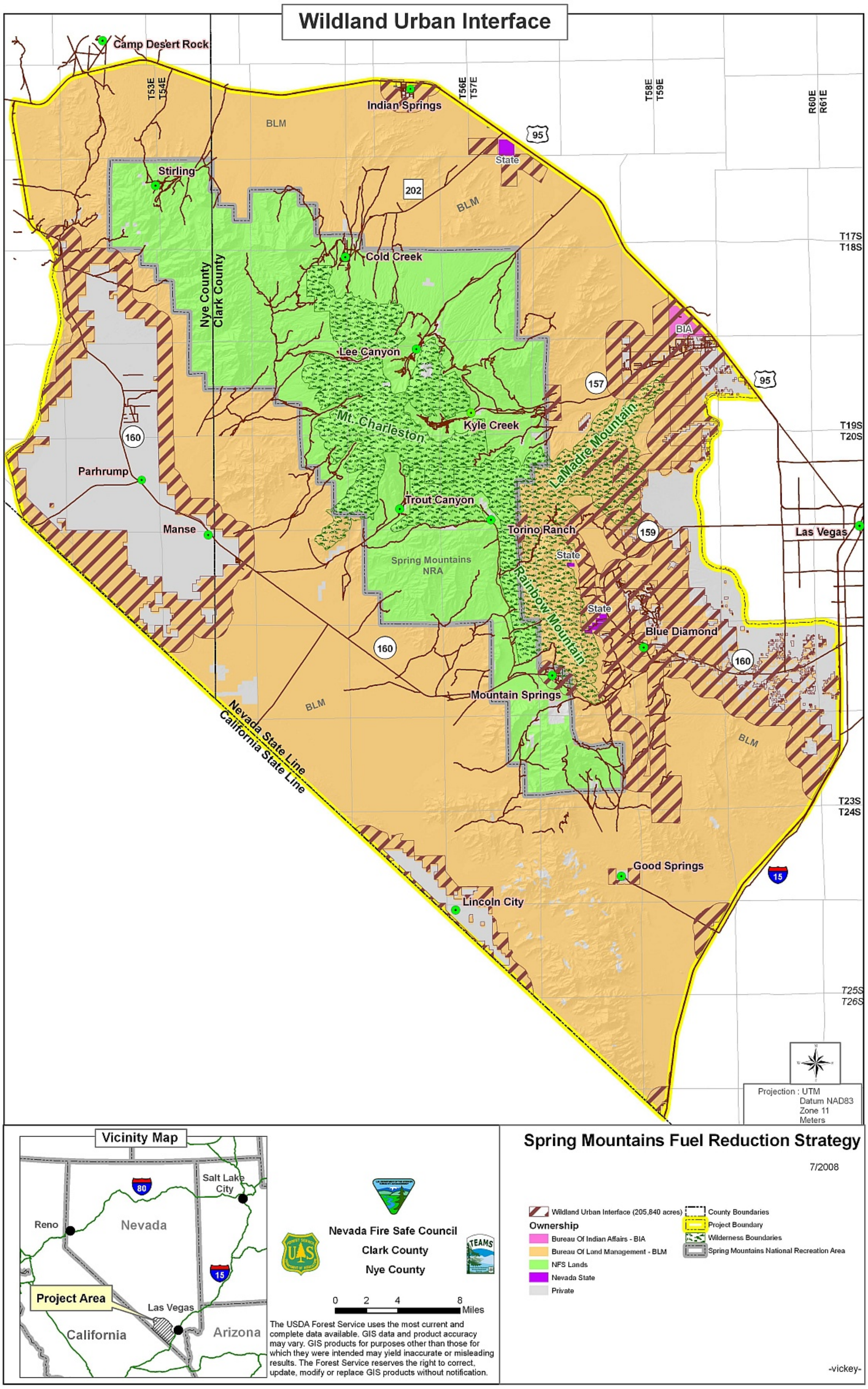


Figure 11. Wildland-urban interface areas in the Spring Mountains strategic planning area

Defense Zone and Threat Zones

The defense zone is defined as the populated urban interface or intermix areas containing primary private property values. In these highly sensitive areas, defense of social values are paramount. Defense zone treatment areas are approximately one-quarter mile wide. Treatments are needed within the defense zone areas to reduce the risk of high-severity wildfire that would threaten highly valued areas. Defense zone areas will focus on reducing tree density and ladder fuels consisting of smaller diameter trees and low hanging limbs, continuous patches of brush, grass, and down woody surface fuels. Treatments are intended to reduce potential for stand-replacing crown fire and fire intensity. The largest trees would be left unless they are deemed a hazard.

Threat zones consist of areas that are immediately adjacent to defense zones. The threat zone would extend out approximately 1.25 miles from the defense zone. Planned treatments will reduce the spread and intensity of fire developing or moving through these areas, and increase the ability of suppression forces to successfully defend interface perimeters. Breaking up the continuity of vegetative fuels is a key action required to reduce risks in the threat zone. In addition to reducing the risk of high-severity wildfire in close proximity to highly valued areas, treatments in the defense and threat zones are also being proposed that modify fire behavior on a landscape level, and create fire-resilient forest stands. The strategy for implementing these treatments relies on a mosaic of fuel treatments that reduces fire spread and intensity. These fuel treatments are called strategically placed landscape area treatments (SPLATS). To be effective, the pattern of the SPLATS must interrupt fire spread and the prescriptions must significantly modify expected, predicted, and potential fire behavior. The prescriptions in these SPLATS are general and will be refined site specifically during the planning and implementation phase. By thinning trees in forested stands and retaining larger trees of the more fire-resistant species available, treatments in SPLATS would create stands where the wildfires, under most conditions, would be of low intensity and severity, with low tree mortality.

Mixed-conifer stands within the project area are much denser, and have smaller, more shade-tolerant, and more fire-intolerant trees than they did historically. Pinyon-juniper stands have also become denser. The tree thinning prescriptions in forested areas would remove small trees, retain the larger trees, remove the less fire-resistant trees such as white fir, and retain the more fire-resistant trees such as ponderosa and Jeffery pine. The stands would become more resilient to wildfires, and to insects and disease.

Treatment Methodology

Treatments are methods used to achieve the prescriptions and desired conditions. The treatment strategy selected depends upon cost effectiveness, availability of implementation resources, the size and type of vegetation to be removed, and site-specific resource protection needs. The primary treatments used in the project area include (but may not apply to every agency):

- community-based treatments
- thinning (hand and ground-based)
- removal (ground-based and aerial)

- pruning
- prescribed burning (pile and broadcast burning)
- mastication
- chipping
- herbicide treatment of vegetation along roads

Biomass Removal

Thinning and Removal

Tree and shrub thinning are used to reduce ladder and crown fuels that affect fire behavior and severity. Ground-based mechanical thinning is generally used on slopes less than 30-35 percent and restricted on sensitive areas, such as riparian conservation areas. Hand thinning is generally used on steeper slopes, and in sensitive areas. Thinned trees and shrubs can be removed by ground-based equipment from slopes generally less than 30-35 percent or by aerial removal systems (helicopter or cable systems) from slopes generally greater than 30-35 percent and sensitive areas.

Pruning

Pruning removes lower branches on trees, increasing the crown-base height (the distance from surface fuels to tree crowns). Pruning is a hand treatment used in conjunction with thinning. Because it must be done by hand and is relatively expensive, its use is generally limited to small areas and where it is most effective and needed.

Prescribed Burning

Prescribed burning reduces fuels using pile burning and broadcast burning. Pile burning is used in areas to reduce concentrations of surface fuels and in situations where it is desirable to burn the fuels under very low-risk wet conditions. Broadcast burning are used on a broader scale to reduce fuels, restore forest health, and mimic the historic process of low-intensity fire.

Mastication (foreground)

Mastication and Chipping

Mastication and chipping are used to reduce ladder and surface fuels. Masticators are tracked or rubber-tired machines that move through the forest grinding, chewing, and shredding fuels. Fuels are ground up into irregular-shaped chunks and left on the ground. The irregular-shapes allow air and water to seep between them, hastening decomposition. Chips are created when material is fed into a chipper and either removed from the site as biomass or spread on site. Chipping creates uniform-sized chips that can form an interlocking mat that decomposes very slowly and inhibits regeneration of shrubs and grasses.

Herbicide Treatments Along Roads

A selected chemical herbicide would be carefully applied along road corridors to reduce the shrub and grass vegetation. Treatments would not extend beyond 150 feet from the road right-of-way.

Community-based Treatments

All projects on private developed lots and small individual undeveloped lots will be consistent with prescriptions and management practices described in “Living with Fire” (Nevada Division of Forestry, Wildfire Protection Guide 1997, Smith 2004). In most cases, projects derived from community wildfire protection plans identify areas where potential treatments could occur. Often these project areas include mixed ownerships where agreements with local landowners are necessary before work can occur. These proposed project zones represent areas of potential projects. If local landowners do not agree to the work, then some areas within the project may not be treated. All treatment methodologies described in this section may be used.

Maintenance and Second-entry Treatments

In most cases, fuel reduction areas will need second-entry treatments to move projects towards their final objective. In addition, to continue these conditions, maintenance treatments may be required. These maintenance treatments and the prescriptions that drive them will depend upon the effectiveness of the initial treatments and how the vegetation responds afterward. In general, fine fuels, such as those in the lowest elevations will need several entries to maintain project fuel conditions in desired states. In other cases, such as where shrub reduction is the primary focus, subsequent treatments with prescribed fire or animal treatments may be necessary to reduce subsequent fine fuel growth.

General Treatments in this Strategy

The specific treatment methodologies discussed above will be used in various combinations to accomplish the prescriptions for each fuel treatment unit. These have been generalized for planning purposes into four general treatments: thin trees/shrubs, community-based treatments, herbicide treatment, and prescribed burning. Specific treatments used in each of these general categories are:

- Thin trees/shrubs
  - Mechanical thinning
  - Hand thinning
  - Mastication
  - Pruning
  - Chipping
- Prescribed Burn
  - Hand pile and burn

    - Broadcast burns
- Herbicide Treatment
    - Road sides
    - Post treatments maintenance for other methods
- Community-based – all previously described treatment methods

Figure 12 displays the total acres of these general treatments proposed in this strategy.

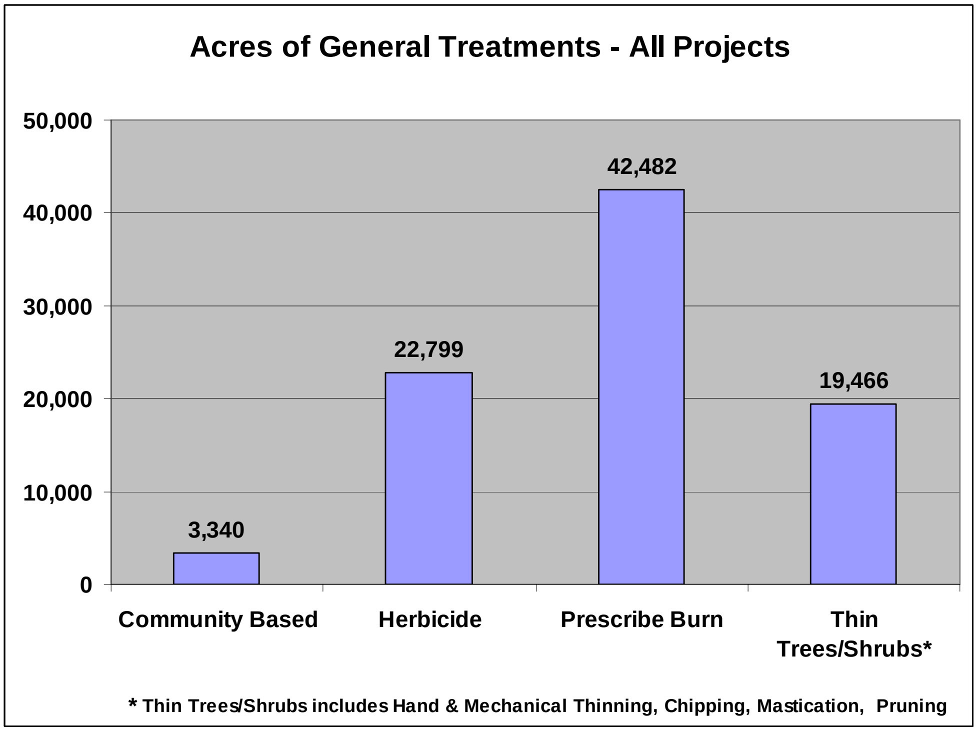


Figure 12. Acres of general treatments

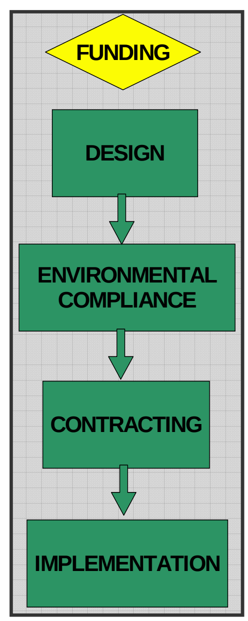
Section 3: Proposed Project Priority

To determine project priorities, all of the proposed fuel reduction projects, the project-wide values at risk, and the relative risk of fire hazard were reviewed. Projects were delineated as those that should occur in the first 5 years of treatment and those in the later 5 years of treatments. In most cases, projects that occur in the second 5 years of treatment represent maintenance or second-entry treatments, projects that require further site-specific planning, or projects that have lowered risk as compared to other project areas. Areas of highest risk in the wildland-urban interface and where treatments have already been initiated were designated first. These included 11 high-risk communities such as Cold Creek, Trout Canyon, Mount Charleston, Lee Canyon, and Mountain Springs (see section Values at Risk).

Table 2. Priority projects (acres) and schedule by county

	Clark County			Nye County			Strategy Wide
Agency/Partner	**0 to 5 Years**	**5 to 10 Years**	**Total Acres**	**0 to 5 Years**	**5 to 10 Years**	**Total Acres**	**Total Acres**
USDI Bureau of Land Management	10,623	1,261	11,884	441	3,092	3,534	15,418
Nevada Division of Forestry	320		320				320
Nevada FSC	3,850	448	4,298		30	30	4,328
USDA Forest Service	14,117	37,959	52,076	123	15,820	15,943	68,020
Grand Total	28,910	39,668	68,578	565	18,942	19,507	88,085

In addition, access and egress routes into heavily used recreation areas and at risk communities were determined to have high priority. Within the 0-to-5 and 5-to-10-year timeframes, priority projects, by county, were established by the planning cadre based on areas that were considered most at risk (Table 2, Figure 11). These projects are the first projects that should be considered during their respective timeframes.



Another consideration is the timeframe it takes to move an individual project through the process of design, compliance, contracting, and final implementation (see flow chart at right). This process may take several months to several years. Therefore, the result of this process is that any given project may actually be accomplished in a different timeframe than that established by this plan. This plan merely represents a strategic framework for the agencies responsible for implementing the projects contained within the plan.

Section 4: Proposed Project Costs

Proposed project costs reported by different agencies in the Spring Mountains vary by treatment (Table 3). Accurate comparisons among communities are difficult because of variations in the condition of individual treatment areas and accounting methods, and because the sequence of implementing treatments affects costs. Detailed costs by project are enclosed in the project proposals of each agency.

Implementation Costs

In general, implementation costs in the Spring Mountains are similar to those reported for other large fuels planning efforts in Nevada (Table 3). Generally, implementation of small-diameter material removal tends to be lower or similar to those reported in the Carson Range and Lake Tahoe. Costs for the removal of larger diameter material run higher than comparisons due to the lack of local operators and markets to accept such products. The parity of costs is a result of collaborative efforts, innovative treatment methodologies, and agency partnerships that accomplish fuel reduction work in the Spring Mountains in a collaborative manner.

Table 3. Implementation costs in the Carson Range and other fuels strategies in Nevada

Treatment	Cost/Acre of Fuels Reduction Strategies (2008 Costs)		
	Spring Mountains	**Carson Range**	**Lake Tahoe Basin**
Mechanical thinning	$800-$3,800	$350–$3,500	$1,000–3,500
Hand thinning	$150 - $2,800	$350–$2,500	$650–$3,500
Chipping	$100-$650	$50–$700	$200–$700
Mastication	$500-$1200	$550–$950	$700–$1,500
Pile burning	$300-$700	$300–$1,500	$300–$700
Broadcast burning	$100-$1,000	$400–$900	$400–$1,500
Herbicide	$70-$100	NA	NA
Community Biomass	$1,500-$4,000	$100-$1000	N/A

Thinning of trees and shrub material represent the greatest cost of the individual projects being proposed in this strategy due the number of acres being proposed and the higher cost of treating those acres (Fig. 13). This type of thinning is accomplished through mechanical or hand type treatments. Although costs per acre can be lower, hand thinning is not necessarily less expensive than mechanical thinning because it may also require pile burning or chipping to remove all of the harvested material. Additionally, hand-removed material is generally limited to small trees and sufficient numbers of trees may not be removed to achieve forest health and/or fuels reduction objectives. Mitigation measures associated with environmental compliance, lack of road access, steep topography, operating near residential areas, and areas with high recreational use, a limited operating season, and coordination between multiple agencies add significant cost to treatments. Treatments in urban lots, parcels, or steeper slopes are generally more expensive than those in other areas. Finally, community based treatments have the highest per cost acre treatment whereas prescribe burning provides the lowest per acre cost.

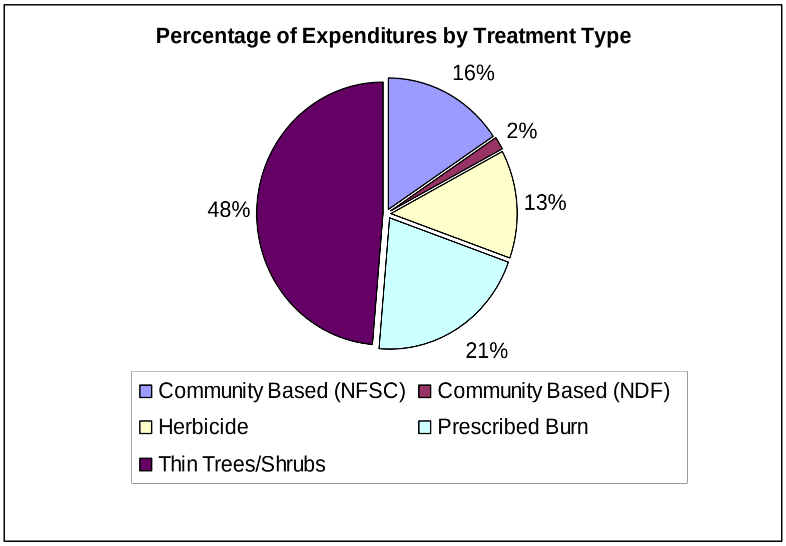


Figure 13. Percentage of expenditures by treatment type

Implementation cost expenditures are detailed by percentage of costs by Agency/Partner in Fig. 14. Implementation costs for community-based treatments on private lands that will be coordinated by the Nevada Fire Safe Council and the Nevada Division of Forestry generally have the highest per acre implementation costs. For this reason, while the USDA Forest Service has the greatest number of acres to be treated (77% of all acres), the overall costs of implementing those treatments reflect a lower percentage costs as a whole.

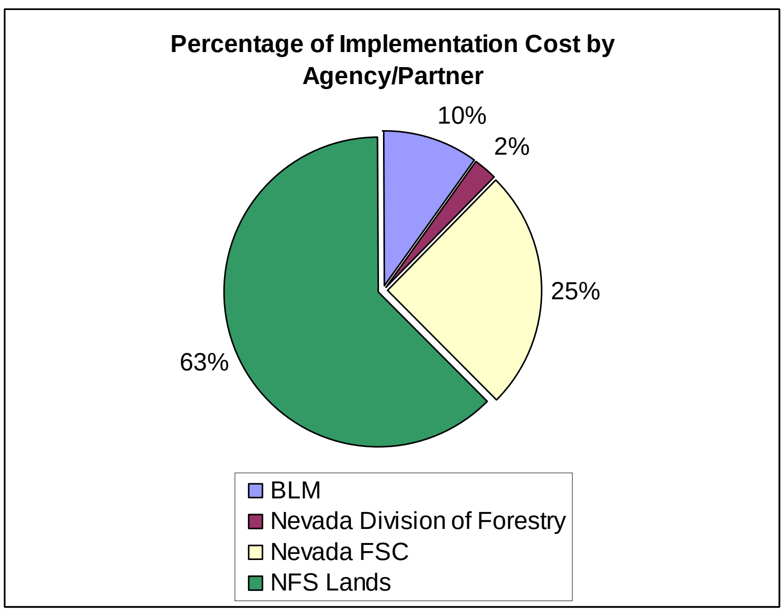


Figure 14. Percentage of implementation cost by agency/partner

Planning Costs

Treatment costs in Table 3 represent implementation costs; they do not include costs for project planning (surveys and project design), environmental compliance, final project layout, contracting, or monitoring. Given the unique ecosystems found in the Spring Mountains, species that must be managed for under the Multiple Species Habitat Conservation Plan, and the locality of recreation destinations within the planning range, planning costs in the Spring Mountains are substantial for many of the agencies. Generally, planning costs for the USDA Forest Service Spring Mountains National Recreation Area run between $500-$600 an acre and the USDI Bureau of Land Management, Nevada Fire Safe Council, and Nevada Division of Lands report costs between $200 -$500 an acre depending on proposed treatment. Overall, because the majority of acres to be treated will occur on National Forest System lands, the USDA Forest Service will have the largest percentage of planning costs to implement the proposed projects (Figure 15).

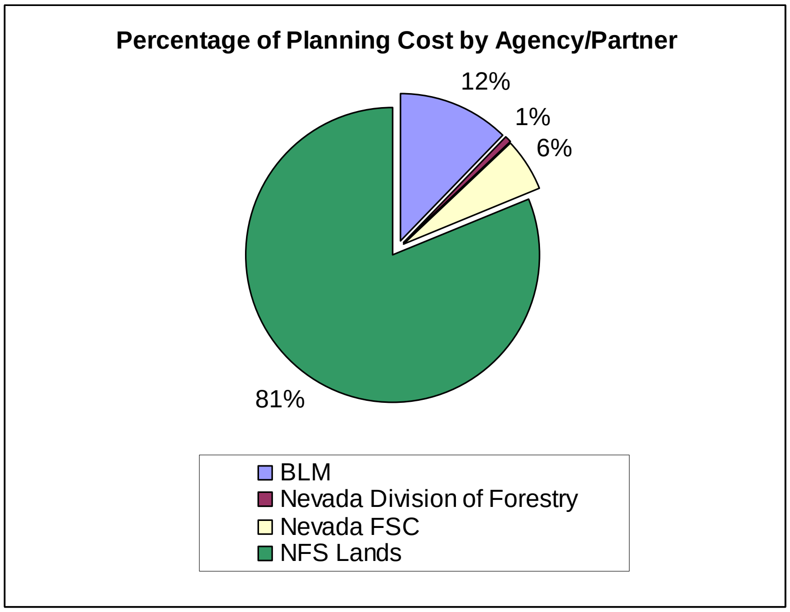


Figure 15. Percentage of planning cost by agency/partner

Total Costs of the Proposed Projects

Note that all implementation and planning cost estimates in this plan represent the best-known data at the time of this writing. Market forces and inflation can obviously affect project costs over time. In addition, because specific prescriptions and treatment methodologies have not been determined for all projects, projected cost estimates must rely on average cost-per-acre ranges. Costs were estimated based on current contract rates and average price per acre for each involved agency. In addition, maintenance treatments were estimated on a project basis. A summary of these costs, by implementing agency/partner is displayed in Table 4.

Table 4. Summary of cost estimates for each agency/partner over three entries

First Entry – 88,085 acres, Second entry - 37,733 acres, Third Entry 16, 114 acres			
Agency/Partner	**Cost Types**	**Projected Costs (Low)**	**Projected Costs (High)**
Bureau of Land Management	Planning Costs	$3,215,498	$4,823,247
	Implementation Costs	$4,378,647	$6,567,971
	Total Costs	*$7,594,145*	*$11,391,217*
USDA Forest Service	Planning Costs	$21,541,624	$32,312,436
	Implementation Costs	$27,092,960	$40,639,440
	Total Costs	*$48,634,584*	*$72,951876*
Nevada Division of Forestry (PVT)	Planning Costs	$127,997	$191,997
	Implementation Costs	$1,043,323	$1,564,985
	Total Costs	*$1,171,321*	*$1,756,981*
Nevada Fire Safe Council (PVT)	Planning Costs	$1,526,231	$2,289,348
	Implementation Costs	$10,890,988	$16,336,482
	Total Costs	*$12,417,219*	*$18,625,829*
Total Planning Costs		$26,411,351	$39,617,027
Total Implementation Costs		$43,405,919	$65,108,878
Total Costs		$69,817,270	$104,725,905

Given the wide range of variables and estimates, this comprehensive plan estimates that total plan implementation costs will range between $70,000,000 and $104,726,000 (rounded) over all jurisdictions, with annual expenditures ranging between $6,800,000 and $16,700,000 (based on variation in acres treated by year). Of these expenditures, the majority will occur in Clark County and will be spread evenly over the lifetime of the strategy.

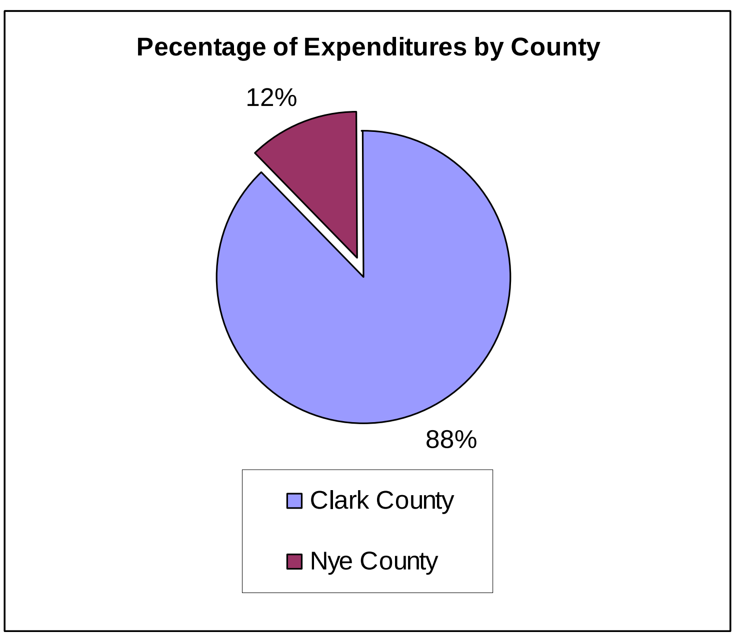


Figure 16. Percentage of expenditures by county

Section 5: Utilization Potential

The primary objectives of the proposed hazardous fuel reduction projects are to reduce the potential of a catastrophic fire, protect valuable assets at risk, and restore forest health. As a result, forest materials that are removed will generally be smaller diameter trees. Materials that are removed may provide some revenue to reduce the cost of the proposed projects, allowing public funds to be used elsewhere for hazardous fuels reduction. On National Forest System lands, this may be accomplished using stewardship contracts or timber sales. Potential forest products from the proposed projects include biomass, small logs, and large logs.

Biomass

Biomass is used to generate heat, steam, and electricity, and create products such as ethanol, soil amendments, or landscaping material. Developing a biomass facility or utilizing existing facilities in or near Las Vegas would be consistent with recent federal and state policies (Appendix A). However, sustainable production of biomass may be limited because projected biomass outputs from treatments proposed in this plan will decrease significantly in 10 to 15 years after first- and second-entry treatments are completed, and because access to projects will be limited.

Support for Biomass

Over the past 12 to 18 months, several strategic actions have occurred that collectively provide the impetus necessary to develop and support a biomass program in or near the Spring Mountains. Key to this success has been commitments for funding and exploration of solutions to resolve regulatory concerns affecting air quality, including:

- The White Pine County Conservation, Recreation, and Development Act recently amended (December 2006) the Southern Nevada Public Land Management Act to provide funding for implementation of hazardous fuels treatments, including biomass energy development.
- The USDA Forest Service’s Spring Mountains National Recreation Area participates in the Nevada Biomass Working Group and has presented opportunities for biomass utilization from ongoing fuel reduction projects.
- In Nevada, the Nevada Division of Forestry has initiated the “Fuels for Schools” program, which promotes biomass as source for heat in public schools.
- The Nevada Biomass Working Group, organized by the Nevada Department of Energy, holds conferences around the state promoting biomass initiatives.

Availability of Biomass

To utilize biomass from the Spring Mountains, trees or shrubs must first be harvested, then processed into biomass, and transported from the project site to a utilization facility. Under current operating conditions, machine access is limited to one-quarter mile from existing roads, making approximately 9,000 acres available for biomass throughout the Spring Mountains. Every acre available for biomass removal may reduce the number of acres that could be burned. Therefore, if access can be developed (temporary or permanent based on acres available within one-quarter mile of existing roads), the number of acres available for biomass throughout the Spring Mountains increases approximately 7 percent to 9,600 acres. Temporary access assumes it is only for the project; such access will be removed, and the site rehabilitated once the project is completed.

Biomass availability is also affected by the timeframe identified for completion of the proposed projects. If access is limited to one-quarter mile from a road and all projects are completed within 10 years, approximately 850 acres would be treated annually. If temporary access is approved for machines, approximately 925 acres would be treated annually over 10 years.

This estimate assumes that biomass may be available from private residences in the course of clearing and maintaining defensible space (up to 100 feet clearance) around occupied buildings. Substantial amounts may be available from initial treatments; however, less will be available from subsequent maintenance treatments because small woody material will develop between frequent treatments.

The amount of biomass available from fuel reduction projects was estimated assuming an average biomass yield of 10.5 green tons (GT) per acre. This is a revised tonnage per acre of that determined by McNiell Technologies (2003) based on derived stand density indexes for average stands in the Spring Mountains. Based on the number of acres treated annually, this would provide approximately 9,400 GT annually for 10 years (94,500 GT over life of plan) if access were limited to one-quarter mile from a road; or 10,800 GT annually, if temporary access was gained, or 108,000 GT over the life the plan. These estimates are gross calculations and may not be accurate based upon final site-specific prescriptions and project design. They represent material available but removal of the material may be further limited by terrain and legal access requirements that may affect the removal methodology.

Existing Demand for Biomass

The demand for biomass in the Las Vegas area are limited and at this time, it is hard to estimate the potential market demand for biomass produced as part of this strategy, Table 5 lists the known potential users of biomass in the Las Vegas area. When possible, agencies may also make available material that could be classified as biomass or small logs as firewood. The USDA Forest Service sells personal and commercial use firewood. Limited markets for firewood exist in the Las Vegas area.

Table 5. Demand for biomass in and near the Carson Range

Facility	Use	Estimated Capacity
A1 Organics, Las Vegas, NV	Compost/mulch	Markets for any amount
Allied Charcoal & Wood, Las Vegas, NV	Firewood	
Asay Creek Lumber, Las Vegas, NV	Firewood	
Dalton Bros., Circleville, UT	Composting/mulch/mills	
Evergreen Recycling, Las Vegas, NV	Recycling	
It'll Gro Inc., Boulder City, NV	Composting/mulch	
Juniper Pellet, Ely, NV	Pellets	
Lunas Construction, Las Vegas, NV	Finger joint lumber, hog fuel, pressboard firelogs, mulch, bioenergy	Markets for any amount
NV Forest Products, Las Vegas, NV	Mulch	
Ponderosa/Rockview Dairies, Las Vegas, NV	Compost	Up to 33,000 tons/yr. Currently using 11,000 tons per year from existing sources. In partnership with A-1 organics
Trussco Sales, Las Vegas, NV	Hhas small portable mill - interested in wood material	
Clark County Schools	Potential FFS	Potential User
EAI - Nevada	Gasification energy	Potential User
Highlands Soil and Water	Composting	Potential User
NORESCO	Energy production at Indian Springs	Potential User; 75,000 tons/per

Small Logs

Small logs have been used to produce pulp, veneer for laminated lumber, oriented-strand board, posts and poles, and sawn lumber. Sawn lumber provides the lower economic return because the juvenile wood that is sawn is subject to extensive warping and cupping. Posts and poles are less susceptible to warping than sawn lumber; however, there is a lack of information on structural use and how to fasten and secure round pieces of wood in traditional structures (USDA Forest Service 2000b). Potential exists to develop a small log market in the Las Vegas area; however, currently there is no industry to support such a market. Limited potential exists to develop opportunities in the landscaping and specialty products market.

Large Logs

Fuel reduction treatments in the Spring Mountains will emphasize removal of small, suppressed, and intermediate-sized trees through prescriptions that thin from below. These prescriptions will include removal of trees greater than 8 inches diameter to be sold as large logs. Presently, due to the high cost of transportation and lack of processing facilities, there is no market for large logs in the Las Vegas area.

Section 6: Values at Risk

Communities, Safety, and Infrastructure

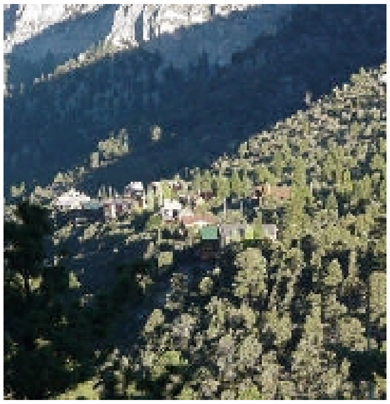


Figure 17. Structures at risk in the project area

Much of the Spring Mountains planning area is adjacent to communities, and is considered wildland-urban interface. Although there are nearly 1.9 million people living within 30 minutes of the area between Clark and Nye Counties, the wildland-urban interface historically has had a small number residences and communities that are affected. Recent land use changes and increased development has seen an increase in the number of homes and communities that are within or adjacent to the Spring Mountains boundaries. Approximately 3,200 homes are considered to be at risk to uncharacteristic wildfire. In addition to this risk, present conditions also diminish firefighter safety, and threaten community infrastructure. The Community Wildfire/Risk Assessment prepared by RCI (see p. 8) showed that 11 assessed communities are in the analysis area and detailed risk assessments describe community infrastructure that is at risk.

Figure 18. Old fire scars consisting of dead brush in project area

In addition, based on the planning cadre's assessment of values at risk, communities in the Cold Creek, Kyle Canyon, Lee Canyon, Mountain Springs, Torino Ranch and Trout Canyon areas were determined to be the most at risk of uncharacteristic fire behavior within the analysis area. For example "Nevada Living With Fire" considers the Mount Charleston area communities to be among Nevada's most vulnerable in terms of wildfire disaster.

Figure 19. Example one way in and out in project area

Four important factors contribute to this wildfire threat. First, the area's steep slopes and narrow canyons; flammable vegetation; and dry, hot, and windy weather create a hazardous fire environment. These conditions can produce intense, uncontrollable wildfires. Evidence of past wildfires is found throughout Mount Charleston's neighborhoods. Fire scars on ponderosa pine trees and charred skeletons of mountain mahogany record the mountain's fire history.

Figure 20. Example fire threat to structures occurring from (Robbers Fire in 2004)

Second, many of the Mount Charleston area houses have been built and are maintained in a manner that makes them easily ignitable during wildfire. Third, because there is only one way in and out of Kyle and Lee Canyons, there is a potential for people to be trapped by wildfire. And fourth, because these canyons experience intense recreational use during the summer fire season, there is a high potential for human-caused ignitions. Common human-caused ignition sources for the Mount Charleston area include vehicle fires, smoking, campfires, cooking fires, and children.

There is no clear demarcation (defensible space) between wildland fuels and the residential structures of the community. In 2004 for example, the Robbers Fire threatened the Kyle community and due to the proximity of continuous fuels adjacent to the community, evacuations were necessary. Fortunately, suppression resources were able to contain this fire before it could impact the community.

Population growth around Forest boundaries has led to increases in wildland-urban interface, most significantly on the east side of the Spring Mountains National Recreation Area. Much of this growth has taken place at lower elevations within or adjacent to dry forest or rangelands. Often, small communities, isolated subdivisions, or owners of concentrated recreation facilities do not have the resources to address fire risk (protection or prevention) or to assist in the control of wildfires. The growth of wildland-urban interface areas increases the risk of wildfire spreading from private to federal lands, and vice versa.

Traditional and Cultural Values

Current fuels and potential fire conditions put traditional cultural values of the Spring Mountains at risk. The Spring Mountains landscape includes numerous places of cultural significance. The cultural resources include plants used for traditional food and clothing, graves, rock art, and places of religious and cultural importance to the Nuwuvi people. The Spring Mountains themselves and Mt. Charleston in particular, are known as the place of creation for these people whose modern descendants include the Southern Paiutes. The Southern Paiute people believe that essential power or energy (puha) flows through the mountains in channels, and water in any form such as springs, steam, rain, and snow is closely associated with puha. In general, there is a connection between higher elevations and puha. Other important uses of the land by the original inhabitants include sites for tool-making, healing places, rites of passage sites, and ceremonial dance sites. The Southern Paiute people believe they are the moral, spiritual, and cultural stewards for these lands, and they work with the Forest Service toward these ends.

Today, members of the Southern Paiute use the Springs Mountains for traditional gathering and ceremonial practices. Disruption or loss of these areas due to uncharacteristic wildfire may impact these processes by loss of pinyon gathering areas, plant collection areas, or traditional sites. In addition, implementation of proposed fuel reduction projects could also impact these uses. Therefore, the site-specific development of these projects and their eventual implementation should be coordinated with resource representatives of the Southern Paiute.

In addition, there are historic structures that are at risk due to wildfire in the Spring Mountains. These include sites of historic context that are tied to National Historic Register themes of Conservation, Politics/Government, Military, and Architecture. The Kyle Canyon guard station includes nine buildings, six of which are eligible for the National Register for Historic Places for several themes including Depression Era Construction. The Kyle Canyon Cap House and the Lee Canyon Guard Station are also eligible for the Register. In addition to these historic resources, Mt. Charleston Peak has been a popular tourism site since the early 1900s, and Mt. Charleston Lodge and Resort has been a popular retreat from Las Vegas heat since the late 1950s.

Forests, Ecosystem Health, and Watersheds

The USFS for SMNRA and the BLM have identified specific areas determined to contain unique biological values to be sensitive habitat. The Nature Conservancy (TNC) evaluated the SMNRA portion of the analysis area in 1992 to determine biodiversity hotspots, or areas where two or more elements of concern overlapped (SWCA 2005b). Following another analysis of these areas in 2005 (SWCA 2005b), it was recommended that these previously identified "hotspots" be extended to include other portions of SMNRA, based on additional detected areas of high biodiversity. Also recommended was the establishment of Special Interest Areas to insure additional management awareness and protection. The BLM's Areas of Critical Environmental Concern (ACEC) delineate where desert tortoise habitat, cultural values, and other specified biological values are the most sensitive. This analysis for values at risk is based on these spatial delineations. Note that these areas are not the extent of known locations or potential suitable habitat for the species that were analyzed in the aforementioned designations, but they have been chosen for this analysis based on the concentrations of biological richness.

This analysis focused on potential risk of fire to these above defined biological values. Other threats exist and should be taken into consideration [refer to Conservation Agreement (USDA Forest Service Intermountain Region et. al 1998), Final Draft Land Analysis (Entrix Inc. 2007), and BLM Land Management Plan (1998)], and some are listed towards the end of this report.

Methodology

The risk of catastrophic fire was qualitatively analyzed as fire occurring outside of the historic range of variability. This risk has evolved for several reasons that are not homogenous across the landscape. For example in creosote scrubland the well-known problem exists of invasive annuals increasing the fire return interval, creating additional suppression needs (Brown and Minnich 1986). Inversely, in the mixed conifer of the white fir -ponderosa pine and portions of the pinyon-juniper woodlands, suppression actions have increased the observed and potential fire intensity, due to decreased fire return intervals. Risks to the biological values were qualitatively analyzed considering the following qualities of each site:

I. The vegetation mosaic of each biodiversity hotspot and ACEC

II. The proximity of nearby ignitions (natural and human),

III. Prioritization of hotspots based on TNC priority designations (SWCA 2005b) and all designated ACEC was considered high priority, and

IV. The combination of above factors combined with the fire regimes per vegetation association to assess the risk level to areas with high biological value (in Section IV, Risk Assessment).

Vegetation Risk Areas

The lower elevations of the analysis area are predominately BLM lands that are dominated by creosote, which is where the concentration of ACEC occur (Table 6). Inversely, SMNRA biodiversity hotspots occur primarily in the higher elevations with pinyon - juniper, white fir - ponderosa pine and bristlecone pine incurring the highest proportion of vegetation assemblage (see Appendix D). Notable high elevation hotspots that are primarily comprised of bristlecone pine and alpine associations are Charleston Ridgeline and Mummy Mountain. Biodiversity hotspots with high proportions of lower elevation blackbrush in SMNRA include Cold Creek, Stirling Mine, Potosi Pass Road and Willow Creek.

Over 10,000 acres were designated for desert tortoise ACEC (see Appendix D), and over 84% is composed of the creosote bush vegetation association. None of SMNRA's biodiversity hotspots occur in creosote bush, but have various compositions of the other associations.

Cliff and rock outcrops occur across all elevation ranges, and species affinity often corresponds with the elevation at which this vegetation association is found. The mixed shrubs vegetation association also spans a large elevation gradient and is found primarily in two bands. One band occurs in the lower elevations intermixed with the lower elevation blackbrush and creosote bush, and another in the mid elevations embedded as a mosaic within the blackbrush association (see Section IV for further discussion).

Table 6. Number of acres of each vegetation association within areas of biological value

Vegetation Association	Areas of Critical Environmental Concern (ac)	Biodiversity Hotspots (ac)
creosote	10,610	
blackbrush	733	765
cliff and rock outcrop	1241	394
mixed shrubs	332	25
montane wash		101
pinyon - juniper		4749
white fir - ponderosa pine		3804
bristlecone pine		4220
alpine		439
Totals	12,620	14,579

Proximity of Ignitions to Risk Areas

The proximity of a biodiversity hotspot or ACEC was assessed using the last 20 years of ignition location and source data. This was assessed qualitatively using GIS for proximity of biological resource to ignition sources. The ignition data was generalized for topographic map sections (a square mile), so one-mile buffers were viewed around the perimeter of the biological values. Then, all ignitions within that buffer were summarized (Table 7). This analysis assessed the proximity to ignition, especially human ignitions, based on recent trends in ignition locations and sources.

All of the biodiversity hotspots occur within a one-mile proximity to natural ignition sources that overlapped spatially. Inversely, all ACEC areas only occurred proximal to anthropogenic ignitions over the 20 years of location data. Approximately one third of the biodiversity hotspots and both ACEC's are located within over 25% of nearby human ignitions (especially Potosi Mountain Spring, Potosi Pass Road, Harris Road, Upper Clark Canyon, Wallace Canyon, Wheeler Well and Willow Creek). Though Upper Kyle Canyon had a higher proximity to lightning ignition, there was still high potential for human-caused ignition. The proximity or overlap of an ignition location does not directly signify that the fire may spread there. In the following section, the proximity for ignition will be analyzed in the context of vegetation association.

Risk Assessment

The above sections on values at risk and fire regimes and ecology were synthesized below and organized into the same vegetation associations to summarize the values at risk. Fuel condition is the main factor controlling fire occurrence in the desert in term of continuity and fuel type (Brooks and Minnich 2006). In this strategy, fuel condition was only included on a broad spatial scale by ecosystem or vegetation association. Smaller scale analysis of trends in fuel buildup or absence will give more detail to managers about pervious and future fire cycles.

Creosote Bush

Over 10,000 acres have been designated as BLM Areas of Critical Environmental Concern (ACEC) and occur within this vegetation association because of desert tortoise habitat (9,657 acres) and for cultural values (952 acres). In addition to these designated areas, most habitat below 5,000 feet is potential habitat for desert tortoise. Increases in the fire return interval have altered the vegetation structure and species composition. This has resulted in post fire dominance of nonnative annuals, which are thought to be displacing food sources for the desert tortoise (Brooks and Esque 2002) and exacerbating its habitat destruction.

Mixed Shrub

The mixed shrub vegetation association has a lower elevation band of desert mixed shrub and a higher elevation band of the big sage vegetation series (Nachlinger and Reese 1996). The desert mixed shrub comprises over 30 acres of ACEC, which is embedded in a matrix of creosote bush. This portion comprises a negligible portion of the ACEC. The big sage vegetation series accounts for the areas of concentrated biological value. This accounts for 5% (24 acres) of the Cold Creek biodiversity hotspot.

Table 7. Displays the numbers of ignitions that have occurred from 1986 to 2006 within one mile of biodiversity hotspots and ACEC

Name of Hotspot or ACEC	Human Ignitions	Lightning Ignitions
Biodiversity Hotspots		
Archery Range		7
Camp Bonanza	4	13
Carpenter Canyon	3	9
Charleston Ridgeline	8	53
Cold Creek	2	12
Deer Ck Hwy Cliffs	1	8
Deer Creek		12
Deer Creek Highway	2	9
Divide Trail	1	5
Fletcher Canyon	4	8
Griffith Trail	2	14
Harris Mtn & Saddle	2	11
Harris Road	4	4
Harris Road End	1	4
Lee Canyon Ridgeline		9
Lee Cyn Gaging Sta	1	5
Lee Cyn Summer Homes	1	5
Lovell Summit		6
Lower Clark Canyon	4	7
Lower Kyle Canyon	2	4
Lower Mud Spr Road	1	3
Lower N Loop Trail		9
Macks Canyon	2	10
Macks Road	2	7
Mahogany Knoll		10
Middle Kyle Canyon	1	11
Mummy Mountain	2	7
Mummy Springs		4
N Fork Deer Creek		12
Potosi Mtn Spring	12	21
Potosi Pass Road	6	8
Robber's Roost		7
Stirling Mine		1
Upper Clark Canyon	4	4
Upper Kyle Canyon	10	54
Upper Lee Canyon	4	27
Wallace Canyon	4	4
Wheeler Well	4	8
Willow Creek	3	4
Areas of Critical Environmental Concern		
Desert tortoise	2	
Cultural	2	

At a coarse scale, many elements of concern that are present in this vegetation association (i.e., Brets blue butterfly and clokey eggvetch); they often enjoy niches (e.g., rock outcrops, washes) within the mixed shrub (SWCA 2005b). Butterflies will visit host plants occurring here, and bats are likely to forage in openings. Though there appears to be little fire history in this vegetation association, the values at risk should be considered within the context of the blackbrush and creosote associations it is embedded in.

Blackbrush

The blackbrush association is made up of two vegetation series: the dominant representation is by the blackbrush - Utah juniper vegetation series and the other is blackbrush - Stansbury cliffrose vegetation series. According to the Landscape Analysis (Entrix Inc. 2007) and the summarized recent fire data above, this vegetation type in the SMNRA portion of the analysis area has had the largest amount of area burnt. For both of the vegetation series mentioned above, Nachlinger and Reese (1996) listed red brome as a widespread or commonly present (1% of ground cover) annual nonnative species and three other annual nonnative plants as infrequent or rarely present.

Blackbrush is an important component for the biodiversity hotspots of Cold Creek, Sterling Mine, Potosi Pass Road and Willow Creek. Though blackbrush totals only 765 acres of the areas of biological value, it constitutes a major component of the entire analysis area. Many of the elements of concern are found within blackbrush and are threatened by increased anthropogenic ignition sources combined with an amplified flammability of the landscape due to invasion by nonnative grasses. Some species of concern appear to have positive responses to fire. For example, for many bats and birds fire creates openings in blackbrush and other vegetation groups that facilitate the thriving of prey on early seral food species and openings that create easy location of prey. For the butterfly species, fire can create habitat for their larval and nectar hosts. For example, the Spring Mountain checkerspots main nectary hosts include yerba santa and Palmers penstemon, which are disturbance followers.

The combination of a high level of threat from the increase in human ignition sources, the slow recovery of blackbrush dominated habitat (up to 100 years), and increased fire frequency exacerbated by flashy fuel nonnative grasses means a cumulative increased risk of probable adverse impacts to the associated species. The risk is that these repeat fires will result in a vegetation type converted habitat type that no longer supports the host and prey species that the wildlife rely on. Repeat fires may reduce the resilience ability of the species with adaptations to this habitat, and the elements of concern present there. For example, Stirling Mine had fire in 2005 and Cold Creek had fire in 1981. Repeat fires in these hotspots could increase the chances of vegetation type conversion occurring.

Pinyon - Juniper

This vegetation association includes pinyon pine, Utah juniper, big sagebrush, point leaf manzanita and many other dominant plants depending upon the vegetation mosaic present at a given site. This vegetation association accounts for approximately one third of the biodiversity hotspots (see Table 8). Very high priority areas (TNC 1994) which have high composition levels of this vegetation association include Middle Kyle Canyon, Upper Kyle Canyon and Potosi Mountain Spring and Road. These areas generally occur in the pinyon pine-big sagebrush series in elevations above 5000 feet. Up at these elevations the overstory canopy closure increases, allowing increased probability for ignitions to spread. As shown in table 5, many of the large fires have occurred in this vegetation association. Given the high number of unnatural ignitions, the history of large fires and the uncertainty of historic fire regimes the biological values within this association have a high risk of potential for catastrophic wildfire.

Another consideration is the mosaic of vegetation within the biodiversity hotspot. The combination of blackbrush with pinyon-juniper seems to have increased risk for larger, more intense fires. This vegetation mosaic combined with high levels of human ignitions can pose increased risk. Potosi Mountain Spring, Potosi Pass Road and Willow Creek share this combination of risk factors. Both Wheeler Well and Potosi Mountain Spring have incurred multiple fires since 1996, and now are threatened for potential, or already present, type-conversion in the blackbrush and shifts to early seral stages in the pinyon-juniper.

Many species of concern are known in the pinyon-juniper association, such as butterflies, bats, Palmers chipmunk, at least 43 of the plant species of concern, and multiple listed bird species. As mentioned in the blackbrush section, the disturbance from fire can create openings that support species, but too much fire can decrease the resilience of a habitat.

White Fir - Ponderosa Pine

This vegetation association accounts for over 3800 acres (a little less than 1/3) of biological value. This association includes large percentages of very high priority biodiversity hotspots, North Fork Deer Creek, Deer Creek, Upper Kyle Canyon and Upper Lee Canyon. These hotspots are also areas of high human use, though lightning is the main ignition source in this ecosystem. A notable exception is Upper Kyle Canyon which has a high number of nearby human ignitions, though the fire history maps do not show many large fires.

The increase in the fire return interval for this association may be decreasing the suitability of the habitat for some species. The resulting dense stands have increased susceptibility to higher intensity fires that may result in destruction of habitat for species that prefer the later seral stages (e.g., northern goshawk). High intensity fire could also injure bats and birds that roost in the hollow cavities or canopies of trees in this ecosystem. Inversely, fire could create habitat for these species. Palmers chipmunk needs course woody debris, which could be both consumed and created by fire. This habitat potentially has the greatest resilience as it could be returned to within its range of historic fire regime with the use of fire.

Bristlecone Pine

Over 4000 acres of delineated biodiversity hotspots occur within this vegetation association. There is low fire risk to these areas though, as fuel accumulation is patchy and fire spread historically and recently infrequent.

Alpine

Ivesia, or mousetail, is an herbaceous species in the rose family that occurs above treeline in alpine areas. This vegetation series is described as stable and long-lived with high levels of natural disturbance. Both natural and human caused fires are listed as common (Nachlinger and Reese 1996). Though ignitions are common, especially lightning in this vegetation association, no recorded large fire history is available. This is presumably due to the sparse vegetation that is unable to support fire spread even during high wind events.

Only two biodiversity hotspots have small amounts of this vegetation association within their boundaries. There is low risk to these biological values in this vegetation zone from fire occurring outside of its natural range of variability. Fires that could occur would be localized and not likely to impact biological resources in a widespread manner. Non-native plants were found present during the survey work of Nachlinger and Reese (1996).

Cliff and Rock Outcrop

This association is found as a mosaic within many of the other vegetation associations. As fire presumably does not have the capacity to spread due to lack of fuels, the majority of impacts would occur on the interface between cliff and rock outcrop with other vegetation. The desert tortoise ACEC and both of the biodiversity hotspots of Upper Kyle Canyon and Upper Lee Canyon have the highest acreage of cliff and rock outcrop. Little risk is present in this habitat except when species of concern occur in the ecotone between associations.

Desert Wash

The vegetation layer in desert washes is often sparse or not contiguous for fire spread. Desert washes are comprised of no tree cover and about 20% shrub and 6% grass/forb cover; it has no consistent dominant plants but averages at 11 species per survey area. The habitat that makes up this zone is described as seral, or intermediate stage of succession, with high levels of natural disturbance including flooding, runoff, mass-wasting, and rare natural and human caused fire and grazing events (Nachlinger and Reese 1996). If many years of vegetation and dead fuels buildup without being buried or dispersed by sediment, then the chance of occasional fire does exist.

This association is marginally desert tortoise habitat and also hosts several rare penstemon species. The greatest threat may be nonnative plants in this vegetation association increasing the potential for fire spread. Red brome (*Bromus rubens*; 1% ground cover) was the nonnative annual grass commonly present during the survey work of Nachlinger and Reese (1996) and the perennial, nonnative crested wheatgrass (*Agropyron cristatum*) was rarely present.

Montane Wash

The vegetation layer in montane washes is often sparse or not contiguous for fire spread. Montane washes on average are comprised of 6% tree, 23% shrub, and 3% grass/forb cover; it has no consistent dominant plants but averages at 12 species per survey area. The habitat that makes up this vegetation association is described as seral, or in an intermediate stage of succession, with high levels of natural disturbance including mass-wasting, grazing, wind erosion, colluvial deposits, and rare natural and human caused fire events (Nachlinger and Reese 1996). If many years of vegetation and dead fuels buildup without being buried or dispersed by sediment, then the chance of occasional fire does exist. The habitat is transitional to point leaf manzanita vegetation series in heavily burned areas.

This is a small but important constituent for many elements of concern. It provides areas with host plants and puddling (damp surfaces where nutrients are extracted) for butterflies, microclimates for various species, and sources of water for other species. The transition to point leaf manzanita with repeat fire could have deleterious implications on habitat for the species dependent upon the microhabitats within this association. Upper Lee and Upper Kyle Canyon have small amounts of this association within their vegetation mosaic.

Though this association has had minor impacts by historical fire, increases in nearby and on site fuels accumulation could result in increased fire intensity, and net loss of suitable habitat. Red brome was the nonnative annual grass occasionally present during the survey work of Nachlinger and Reese (1996), and crested wheatgrass was rarely present.

Decreases in overstory vegetation could increase solar radiation, impacting moist microclimates that are important for many species. Assessment for risk should be site specific and the vulnerability of the surrounding vegetation to catastrophic fire taken into consideration.

Ecosystem Values at Risk

Though this analysis has focused on defined biological values, there are other potential values at risk. SWCA's (2005b) proposed Special Interest Areas found very high biodiversity (please refer to document for ranking criteria) in the Mountain Spring and Lower Lee Canyon areas. Mountain Spring has blackbrush, pinyon-juniper, cliff and rock outcrop associations and is located in a wildland-urban interface. Lower Lee Canyon is in SMNRA and has creosote, blackbrush and desert wash associations, and lies along a high-use road.

Older tree stands are potential fire refugia habitat, and have been known as areas that host a unique assemblage of species (Pearson Ramirez, pers. comm. 2007). Pinyon, Juniper, mountain mahogany, bristlecone pine, limber pine, ponderosa pine, and others can have long life spans when ecological processes allow. These older stands become similar to special habitat, in terms of stand age and individual tree characteristics of canopy shape and bole diameter. These stands can have both sparse un-contiguous fuel layers and pockets with higher levels of canopy closure and fuel accumulations relative to the surrounding landscape. Some of these old tree species are very susceptible to high intensity, stand-replacing fire. As mentioned earlier, some stands may not have burned due to topographic location and natural fuel breaks in relation to past fire spread (Hall and Oliver pers. comm. 2008), so those older growth pockets may be considered Fire Regime III to V, which can be uncommon regimes for the most of analysis area.

There are many species not included in biodiversity hotspots and ACEC, and for the species located in the hotspots and ACEC, these are only portions of their distribution within the analysis area.

Watershed values are susceptible to increased sediment when the surrounding vegetation has incurred high severity fire. As there is slow soil development in the analysis area the removal of vegetation by fire could greatly increase erosion during rain events until vegetation grew back.

Fragile biological soil crusts exist across large expanses of the desert, from the desert scrub to pinyon – juniper elevation ranges. They are historically found in the open spaces between plants in many arid ecosystems (Entrix Inc. 2007). These soil crusts are at risk from changing vegetation types due to the invasion of nonnative plant species and increased fire frequency and human response to fire, such as suppression activities.

Section 7: Proposed Project Predicted Outcomes

To determine the efficacy of this plan and its associated proposed projects, it is important to first establish the current wildland fuel conditions, then determine a desired wildland fuel condition for the Spring Mountains, and finally determine whether the proposed projects will meet that desired condition.

Current Condition

Fire History and Occurrence

The number of acres burned by wildfires in the Spring Mountains has been higher in this last decade than previous decades (Figure 21). Some of the more notable fires that have threatened communities within the project area are the Goodsprings fire in 2005, Robbers Fire 2004, the Lost Cabin fire in 2002, the Zipper fire in 1987, the Cold Creek fire in 1980 and the Willow Pass Fire in 1961. These fires are often severe and burn with rapid rates of spread.

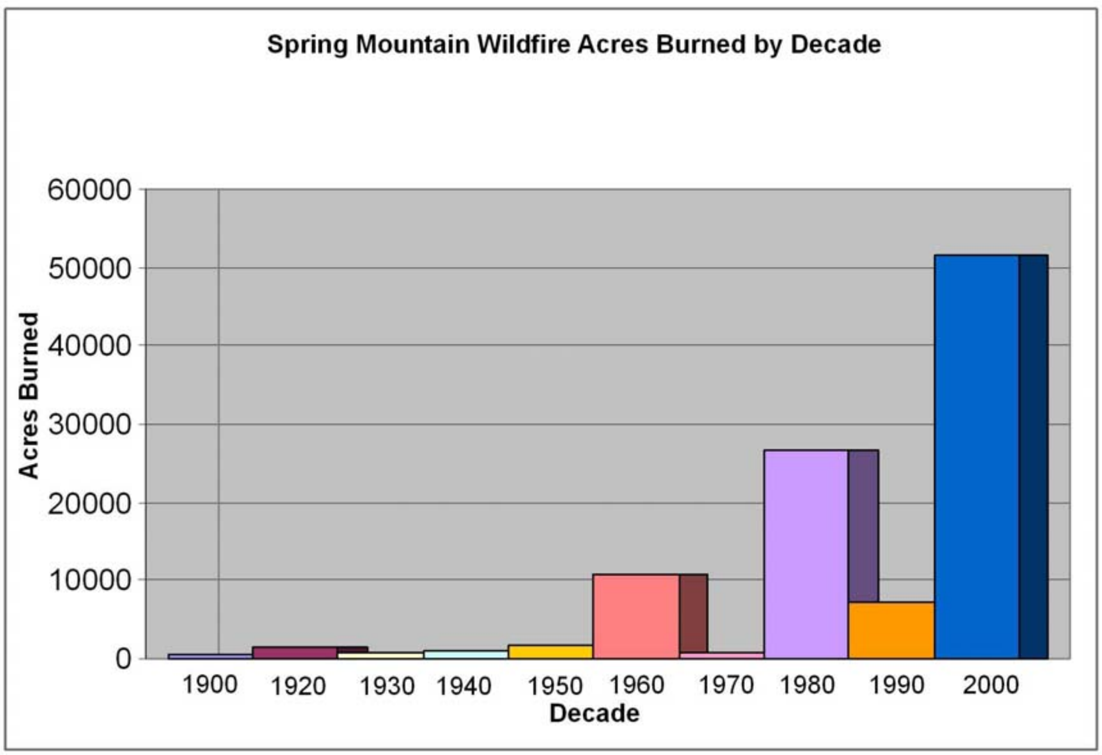


Figure 21. Wildfire acres burned in the Spring Mountains area by decade

The Goodsprings fire for example was lightning ignited southwest of Las Vegas. Fanned by high winds, heavy fuel accumulation and hot and dry weather, this fire ultimately consumed 33,569 acres (15,835 acres of Bureau of Land Management land; 9,195 acres in the Red Rock National Conservation Area; 7,724 acres in the Humboldt-Toiyabe National Forest; and 815 acres of private land). The fire threatened residents in the Goodsprings and Mountain Springs communities and the southwest suburbs of

Las Vegas, as well as a Boy Scout camp and a church camp nearby. The fire also threatened critical communications sites, sensitive plants and wildlife. At the height of the incident, more than 500 fire personnel battled the blaze. Even with highly effective suppression resources, the fires and the sizes of these fires provide additional evidence that fuel hazards in the analysis area have increased substantially and will continue to increase in the years ahead.

Large fires by decade recorded within the planning area from 1920 to the present are displayed in Figure 22. Figure 23 displays fire occurrence over the landscape from 1986-2006. This map shows that fire ignitions are abundant and widespread, with most lightning-caused fires occurring in July and August, and most human-caused fires occurring in June and July.

Current Vegetative Conditions and Fire Regimes

The planning area contains a large number of vegetation types. Vegetation varies primarily with elevation and precipitation; there is a gradient from desert type ecosystems at the lowest elevations to great basin shrublands and pinyon-juniper woodlands, to ponderosa pine and mixed conifer forests, and finally to subalpine bristlecone pine at the highest elevations. One vegetation association classification (source: LANDFIRE) recognizes 12 vegetation types in the analysis area, including non-vegetated areas such as “Barren”. The major vegetation types are Mojave Mid Elevation Mixed Desert Scrub (53 percent) and Great Basin Pinyon-Juniper Woodland (12 percent) (Table 8). Table 8 only lists vegetation types greater than or equal to 1 percent. Vegetation types not listed comprise approximately 5 percent of the analysis area.

Table 8. Existing vegetation types within the Springs Mountain Comprehensive Plan analysis area

Existing Vegetation Type	Percent
Barren	1
Inter-Mountain Basins Montane Riparian Systems	1
Developed-Low Intensity	1
Great Basin Pinyon-Juniper Woodland	12
Developed-Open Space	1
North American Warm Desert Sparsely Vegetated Systems	8
Inter-Mountain Basins Subalpine Limber-Bristlecone Pine Woodland	1
Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland	1
Southern Rocky Mountain Ponderosa Pine Woodland	1
Great Basin Xeric Mixed Sagebrush Shrubland	1
Mojave Mid-Elevation Mixed Desert Scrub	53
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	13
Sonora-Mojave Mixed Salt Desert Scrub	1

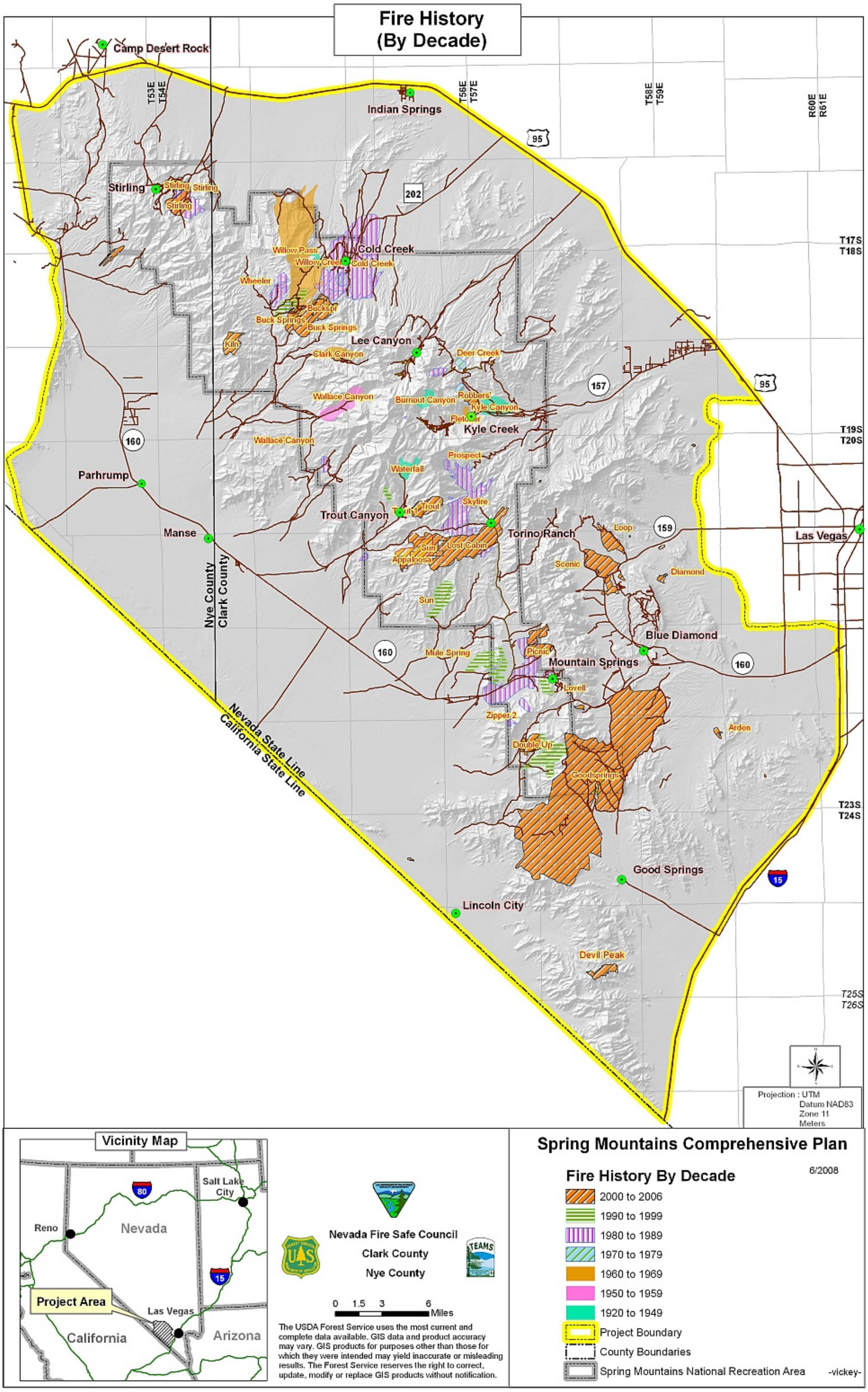


Figure 22. Fire history in the Spring Mountains area

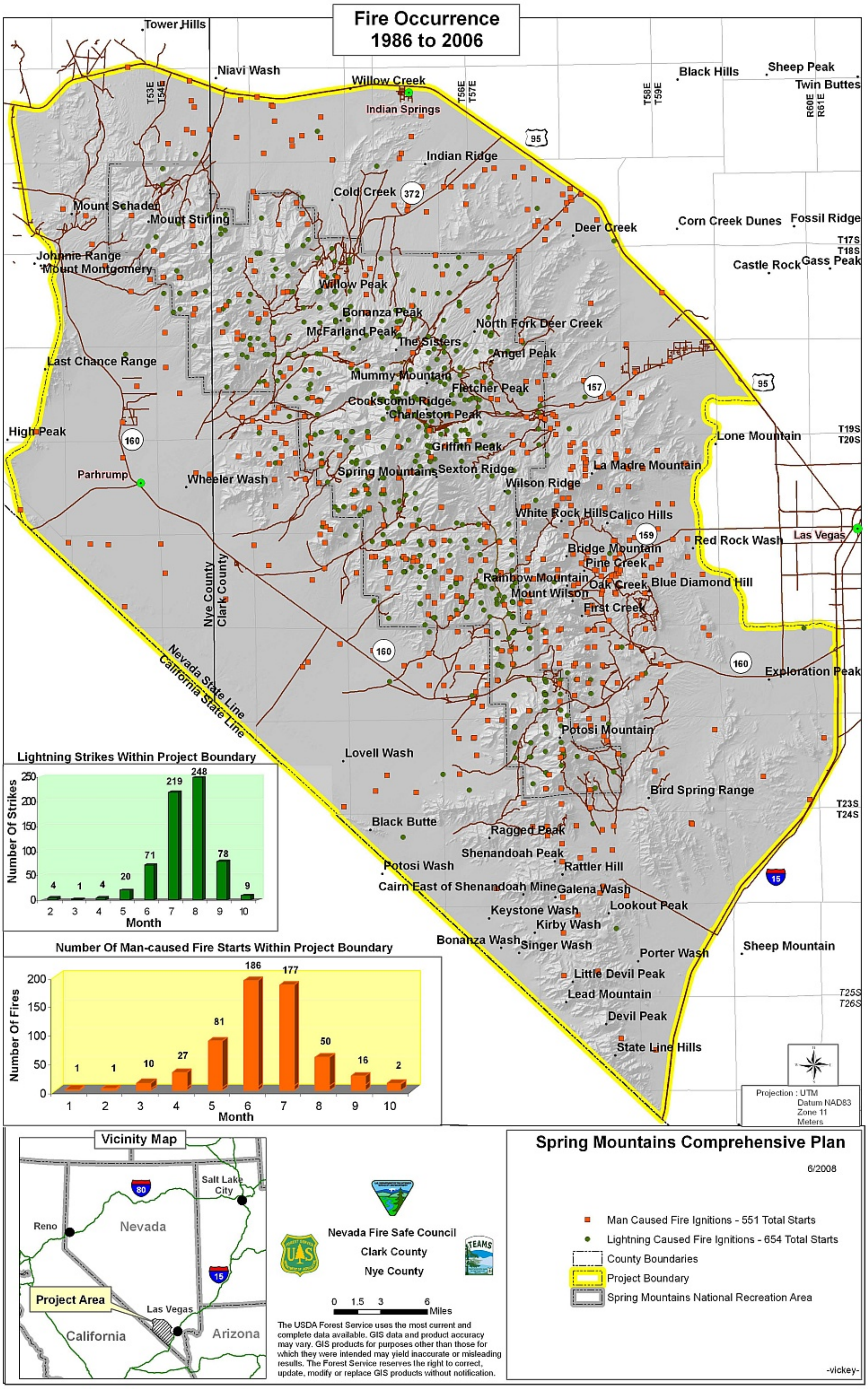


Figure 23. Historic ignitions in the Spring Mountains area

The vegetation types shown above form general zones based on precipitation and temperature changes with elevational changes. At the lowest elevations, non-forest shrubland vegetation types dominate. With increased elevation, the area transitions from mixed desert scrub to pinyon-juniper woodland then to coniferous forest. Within the generalized zones, slope, aspect, soil types, precipitation, temperature, and disturbances interact to create a very mixed landscape.

The analysis area has marked biological resource values, especially the Spring Mountains, where there are high rates of endemism (species restricted to Spring Mountains). As this range is a part of a series of "sky islands" there are presumably refugia species (species that have survived in a habitable area that is surrounded by uninhabitable areas) that have been separated by surrounding desert from other potential habitat. This has resulted in unique flora and fauna that are rare by limitations due to the nature of the landscape. The analysis area also hosts threatened, endangered and sensitive species that have much broader distributions, but whose rarity is the result of anthropogenic habitat destruction. This is as well the case in the surrounding Mojave Desert ecosystems where endangered species such as the desert tortoise, are rare due to anthropogenic habitat destruction.

Tree species found in area forests and woodlands include, ponderosa pine (*Pinus ponderosa*), southwestern white pine (*Pinus strobiformis*), bristle cone pine (*Pinus longaeva*), white fir (*Abies concolor*), limber pine (*Pinus flexilis*), subalpine fir (*Abies lasiocarpa*) quaking aspen (*Populus tremuloides*), pinyon pine (*Pinus monophylla*), and juniper (*Juniperus* spp.).

Past natural disturbances, land use, and management have influenced landscape vegetation patterns and ecosystem dynamics in the Spring Mountains. Human activities, especially fires and responses to fires, have influenced the analysis area's fire history. Native Americans have been visiting and/or inhabiting the area since about 14,000 to 11,500 years ago. Specifically, the Southern Paiute have been in the area since about 5000 to 800 years ago, with some estimates quoting their presence starting about 1150 A.D. The first Euro-American settlers arrived in the 1850's, with permanent dwellings starting in the 1870's (Entrix Inc. 2007), predominantly for mining and timber extraction. Although no documentation of fire occurrences or early uses of fire has been found for these groups of people in the Spring Mountains, human ignitions likely have occurred across the landscape of the analysis area for thousands of years.

Although some fire documentation exists beginning in 1924 (Entrix Inc. 2007), the documentation of wildfire in SMNRA became better documented in 1954. Analysis of the fire record incorporates all documented fire perimeters. The last few decades of documented fire ignitions and perimeters provided for a GIS spatial analysis of the recent fire trends.

Human influences continue to be abundant in the analysis area. The Las Vegas urban area borders the east side; the Pahrump area borders and is encompassed within the west side; and the Indian Springs community and Nellis Air Force base border the north side. Multiple recreation attractions are utilized within the analysis area throughout the year. It is also likely that as human development and visitation have increased, so have the amount of invasive nonnative plants (Klinger et. al 2006) and human related fire ignitions.

On a landscape level, the recent trend is for human caused ignitions to occur over a larger spatial area. This increases the probability for ignition in vegetation associations that both historically and recently had received few lightning ignitions. For example, in the creosote bush vegetation association, the ignition potential has more than doubled with human source ignitions. Human settlements in the Spring Mountains have impacted, and will continue to potentially impact, forest and shrubland composition and structure. These impacts subsequently contribute to changes in fire hazard, watershed hydrology, and terrestrial habitats.

Fire suppression and favorable climatic conditions for conifer establishment have led to high stocking levels and fuel accumulations in the coniferous forests and an increase in white fir abundance compared to historic levels (Figure 24). In some areas historically maintained as open pine-dominated stands, the density of trees has reached three to five times historic stocking levels. High densities of trees increase competition for nutrients resulting in higher tree mortality rates due directly to competition, and higher potential for mortality due to insects and diseases. Since the early to mid-1990s, insect mortality has declined to more endemic (natural) levels and is building up again to epidemic levels.

Figure 24. Example of dense forests with high fuel accumulations

High levels of tree mortality, particularly white fir, have dramatically increased the number of standing dead trees and downed logs. Smaller mid-story trees create fuel ladders that allow fires to readily move into dense crowns. The lack of frequent, low-intensity fires has resulted in accumulations of dead fuels, increased understory shrubs, and dense young trees. As a result, flame lengths and rates of fire spread lead to higher intensity fires (Fire Modeling 2008). Residential, commercial, and infrastructure construction have also influenced today’s vegetation patterns.

The long history of fire suppression combined with incidences of drought has resulted in stands with a high concentration of hazardous fuels. This condition has increased the threat of large catastrophic fire and is indicative of a forest where many natural processes have been excluded.

Historic Fire Regime

Fire intensity, frequency, and size have been altered across the planning area. Fuel loading has changed with the encroachment of pinyon-juniper into sagebrush habitats. Historically, fuel loads were lower in many areas of the Forest, and areas with high loads were smaller and more isolated.

Although little to no historic fire regime research has been conducted in the area, inferences about historic fire regimes have been gathered from research in similar ecosystems, similar dominant vegetation, and similar key underlying environmental factors affecting fire behavior such as precipitation and elevation, as well as recent patterns of ignition locations and larger fire perimeters. Fuel condition is the primary factor driving fire occurrence in the desert in terms of continuity and fuel type (Brooks and Minnich 2006), but in this report fuels were considered only on a broad ecosystem scale.

Precipitation patterns have been a large factor affecting understory species growth and fuel continuity that set the stage for fire growth and more common homogenous burn patterns. Variations in amounts of interannual and multi-decadal patterns (30 year cycles) in precipitation are high in this bioregion. Their variations in precipitation amounts have been documented to effect fire frequency and severity (Brooks and Minnich 2006). Fire regimes are greatly affected by the ephemeral populations of fine fuels from understory plants, mostly annuals. These fine fuels are made of both native and nonnative species that persist in the desert ecosystems for multiple years, especially following year of greater precipitation (Oliver pers. comm. 2007, Brooks and Minnich 2006).

The National Fire Plan's fire regime classification system was applied to each vegetation or ecosystem group (FRCC 2008, Table 9). This system is based on mean fire return intervals (frequency) and fire severity in terms of effects upon the vegetation, with emphasis on the dominant overstory vegetation. Also listed are some modifications, specifically for the Mojave Desert island ecosystem. Further distinction was made within some vegetation associations that contain greater variability or finer scale patterns (Table 9). Synthesized below are also some of the main ideas discussed by Brooks and Minnich (2006) for the fire regimes and ecology of the Mojave Desert bioregion.

Table 9. Historic fire regime groups, as stated in the *Fire Regime Condition Class Guidebook* (FRCC 2008). Modifications in *italics* are adapted for the Mojave Desert island ecosystems.

Fire Regime Group	Frequency	Severity	Severity Description
I	0-35 years	Low - mixed	Generally low-severity fires replacing less than 25% of the dominant overstory vegetation; can include mixed severity fires that replace up to 75% of the overstory
Ia	0-35 years	*Mixed - Replacement*	*Generally mixed to high-severity fires, with plant community conversion, replacing more than 25% of dominant overstory vegetation, pre-fire vegetation may only return to site after long time interval*[1]
II	0-35 years	Replacement	High-severity fires replacing greater than 75% of the dominant overstory
IIa	*30-100 years*	*(same as above)*	*(same as above)*[2]
III	35-200 years	Mixed - low	Generally mixed-severity; can also include low-severity fires
IV	35-200 years	Replacement	High severity fires
V	200+ years	Replacement - any severity	Generally replacement-severity; can include any severity type in this frequency range

1 **Regime I** modified for herb/grass annual encroachment into desert shrublands, blackbrush, and some pinyon - juniper and mountain mahogany; recent regime.

2 **Regime IIa** modified for longer frequency and higher severity for mixed shrub, creosote, blackbrush, and some mountain mahogany areas; subgroup of historical regime.

The assigned historic fire regime group (taken from table 2), inferred fire return intervals, and dominant trees and shrubs are shown in table 3. The information sources and the area the information was taken from, when different than the analysis area, were also included. In other words, table 3 links the historic fire regime class to the document fire frequencies. The fire effect severity was generalized here based on the dominant species, known responses to fire and other disturbances. The fire regimes and frequencies can be used to categorize the landscape into fire cycles. For example, table 3 lists three fire regimes for the pinyon – juniper association, depending upon the ecological conditions of the site containing fine fuels, manzanita, or the local topographical anomalies of the SMNRA that have of long term fire return intervals. A few changes in documented fire return regimes that have occurred more recently were also listed for some vegetation associations as well as regimes for subgroups where a different species codominates or dominates a site within that vegetation category. Often historic fire regimes are still found within each vegetation category, yet they are often intermixed with recent regimes and subgroups of regimes.

Current Fire Regime

As Europeans settled in the area, several factors contributed to changes in the fire regime and fuel hazards. The frequent seasonal fires set by the Washoe Tribe were eliminated and being replaced by active suppression of all fires by federal land managers. Grazing by livestock reduced fine fuels and in turn reduced fire ignition and spread. Active fire suppression reduced the number of fires and fire sizes. As a result, fire return intervals have been lengthened and fires have become more intense and severe. In conclusion, disturbance by fire was a frequent and normal part of the historic vegetative condition, but conditions have changed since the 1860s.

Previous management direction that focused on protection of natural resources by suppressing all wildfires removed a natural source of vegetation disturbance. Simulated fire behavior in the analysis area and observed fire behavior in wildfires that have occurred within the last two decades demonstrates that current fire behavior is characterized by high-intensity fires. The historic fire regime is characterized by frequent, low-intensity fires. The frequency of these fires has been altered by this management and thus has resulted in denser vegetative stands. High-intensity wildfires will result in high tree mortality in forest stands, could result in extensive property loss, and could cause large amounts of erosion and sedimentation that would adversely affect water quality.

Fuel loadings have increased and areas with moderate to high fuels are larger and more contiguous primarily due to fire suppression. Resources available to fight fire are sometimes limited, particularly when multiple areas are burning within the Forest and across the country. These factors, in combination with certain weather conditions, can lead to large fires.

The recent fire boundaries of all GIS mapped fire sizes for the analysis area were spatially viewed according to amounts of vegetation burned, regardless of known ignition source. Documentation of fire boundaries seemed to be more readily available for larger size fires (100 or more acres), so table 4 mostly summarized acres burned in this fire size class. Documentation of larger fire boundaries was not uniformly recorded in the early part of the century. Nevertheless, all recorded recent fire boundaries were included, with those since the 1950’s being most thoroughly documented in SMNRA.

Table 10. Historic fire regime group and fire return interval for each ecosystem group

Historic fire description: temporal and spatial dimensions and magnitude (Brooks and Minnich 2006)	**Historic Fire Regimes**		**Current Fire Regimes** (*intermixed on landscape with historic fire regimes)*	
	Fire Regime Group code I – V (Table 2)	**Fire return interval (FRI, years)**	***Fire Regime Group code I – V*** (Table 2)	**Fire return interval (FRI, years)**
fire season-spring through fall; truncated long FRI; **small fire size; high spatial complexity;** **low intensity, moderate severity, surface fires**	**Creosote Bush**			
	IIa, high severity	FRI: <35years to <100years (FEIS, Howard 2006)	Ia, *high severity, some conversion of plant community*	0-35 years, creosote has a wide range of post-fire survival rates (Brooks and Minnich 2006)
	Mixed Shrub			
	II or IIa, high severity	FRI basin big sagebrush: variable historic records of 30-70 years or 12-43 years	Ia, *high severity, some conversion of plant community*	5-70 years; average every 5 years with nonnative annuals; fine fuels amount increase after high rainfall year; ephemeral production of fuels
	I or II for subgroup with ***ponderosa pine****:*	FRI sagebrush with ponderosa as dominant: 2-45 years, FRI ponderosa when sagebrush as dominant: 12-43 years (FEIS)	most areas still follow historic fire regime, but small fraction of low elevation zone of Mojave overall: fine fuel invasions have potential to increase fire size, decrease spatial complexity, increase fire frequency but decrease intensity because of replacement of woody fuels by annuals (Brooks and Minnich 2006)	
fire season-spring through fall; long FRI; **moderate to large fire size; mixed spatial complexity;** **moderate intensity; moderate to high severity,** **passive to active crown fires**	**Blackbrush**			
	IIa, high severity or replacement; *some Ia mixed-high severity or replacement, conversion of plant community*	FRI: <35years to <100years (FEIS)	*IIa, high severity or replacement;* *and increasing amounts of Ia, mixed-high severity or replacement, conversion to herbaceous/grass community*	higher elevation areas have increased fire frequency than lower elevations; ability of blackbrush to resprout varies post burn, blackbrush stand may recover within 50-75 years, but often takes more than 100 years (Brooks and Minnich 2006)
	subgroup with ***basin big sage*** *as co-dominant or dominant:*		*Ia, high severity, some conversion of plant community*	FRI with basin big sage: 12-43 years, burns frequently, often with high or increasing frequency as annuals/nonnatives invade or establish post fire (FEIS, Nachlinger and Reese 1996)
	IIa, high severity or replacement for subgroup with ***Joshua tree*** *subgroup with* ***Juniper*** *(see below):*	Joshua tree: frequency may increase as it's a lightning strike target (FEIS)		Joshua tree is frequency killed by fire and resprouts have high mortality rate, post fire recruitment is sparse within 40 years of burn (Joshua Tree National Park), post fire species survival is variable on region (Brooks and Minnich 2006)
fire season-summer to early fall; long FRI; **moderate to large fire size; low to moderate spatial complexity;** **moderate to high intensity; high**	**Pinyon – Juniper**			
	I, low to mixed severity with fine fuels; *II, high severity or replacement;* *V, generally high severity or replacement (can be any severity) for some sites local to the Spring Mnts., may*	variable FRI of pinyon pine: (a) 15-20 years at high productivity sites with fine fuels (higher elevations), grass fire is frequent and low-severity; (b) 50 to 100+ years at less productive sites with patchy fuels (lower elevations), local stand replacement fires during extreme conditions	*same as historic regimes and some Ia patches, mixed to high severity or replacement*	fire frequency increased by ephemeral production of fuels; P-J usually dies post fire, can re-establish after 100 years (Brooks and Minnich 2006)

severity; active crown fires	*include a mnt. mahogany component*	FRI Utah Juniper: 10-30 years (in AZ, FEIS)		
	II, mixed to high severity or replace-ment for subgroup with ***manzanita***			
fire season-summer to early fall; short to moderate FRI; **truncated small fire size; moderate spatial complexity;** **multiple intensity; multiple severity; passive crown fires**	**White fir – Ponderosa pine**			
	White Fir/Ponderosa Pine, *I, low to mid. elevation pine; occasional II, often higher severity for fir; V for some mixed conifer sites local to Spring Mnts., i.e. mahogany, limber pine, and Pinyon-Juniper* *subgroup with* ***limber pine*** *(see below or Appendix E)*	FRI ponderosa: historically (pre 1900) 1-30 years low severity surface fires; infrequent mixed-severity and stand-replacement fires (FEIS); FRI 5-25 years, relatively frequent, low severity fires (SW region, Debano et. al 1998) FRI lower elevations: 1-15 years, frequent surface fires; and higher elevation mixed conifer: 1 to 31 years (FEIS) FRI White fir: frequent low severity fires, also high severity, stand replacing fires, esp. during severe weather, 2-30 years with ponderosa as dominant (FEIS)	*Ia, some type conversion of plant community*	
	IIa, mixed severity, subgroup with **mountain mahogany as** *dominant, also V*	FRI curlleaf mountain mahogany as dominant: 13-100+ years		
	IIa, subgroup with **Gambel oak**	FRI with Gambel oak as dominant: <35 to <100 years		
	IIa, subgroup with **Pinyon-Juniper,** *also V (see above)*	FRI with Pinyon-Juniper as dominant: <35 years		
fire season-summer to early fall; short to moderate FRI; **truncated small fires, patchy spatial complexity, variable severity, passive crown fire during extreme weather conditions; surface fires extremely rare**	**Bristlecone**			
	III when bristlecone as dominant, mixed to low severity; *I and II with other conifers, mixed severity*	FRI Bristlecone pine has 2 intervals: high elevation has infrequent, low severity, small fires; in lower subalpine it has more frequent fires of mixed severity; With ponderosa as dominant FRI is listed as 2-30years (FEIS)		
	III and V with limber pine *as dominant; more or less than 200 year frequency, low to high severity or replacement*	FRI limber pine: long and unpredictable, up to 1000 years depending upon fuel buildup and other site factors (Nachlinger and Reese 1996, FEIS); FRI unknown for limber pine with bristlecone pine (FEIS) *(See Appendix E for more information on limber pine regimes)*		
	IIa, subgroup with **Pinyon-Juniper,** *also V (see above)*	FRI with pinyon-juniper as dominant: <35 years		
	I or II, low to high severity or replacement for subgroup with ***ponderosa pine***	FRI with interior ponderosa as dominant: 2-10 years (FEIS)		

Alpine		
Ivesia (mousetail): natural and human caused fire listed as common (Nachlinger and Reese 1996) *Regime III to IV (inferred from FRI)*	For entire desert bioregion between 1980 to 2001 less than 1% of all fires and area burned occurred in Kuchler's alpine meadows-barren, great basin pine, and mixed conifer vegetation types of montane ecological zone combined (Brooks and Minnich 2006)	Ivesia occurs above treeline in alpine areas; described as stable long-lived vegetation series with high levels of natural disturbance (Nachlinger and Reese 1996)
Cliff and Rock Outcrop		
random, infrequent fire occurrences (Nachlinger and Reese 1996) *Regime III to IV (inferred from FRI)*		vegetation layer often sparse or not contiguous for fire spread (Nachlinger and Reese 1996)[1]
Desert Wash		
random, infrequent fire occurrences: natural and human caused fires were rare. (Nachlinger and Reese 1996) *Regime III to IV (inferred from FRI)*	For low elevation riparian woodland or oasis zone (springs): fires only carry under extreme fire weather conditions and continuous low moisture fuels; fire season-spring to fall; short to moderate FRI; small to moderate size fires, low spatial complexity, high intensity, multiple severity, passive to active crown fire (Brooks and Minnich 2006)	Vegetation layer often sparse or not contiguous for fire spread (20% shrub and 6% grass/forb cover; Nachlinger and Reese 1996)
Montane wash		
random, infrequent fire occurrences: natural and human caused fires were rare. (Nachlinger and Reese 1996) *Regime III to IV (inferred from FRI)*		Vegetation layer often sparse or not contiguous for fire spread (6% tree, 23% shrub, and 3% grass/forb cover). (Nachlinger and Reese 1996)

[1] Note, table 6 listed that cliff and rock outcrop was the lightning ignition location of one 90-acre fire. The ignition site is surrounding by large areas of pinyon – juniper and blackbrush (CC Springs Fire of 1996), so this may be a significant, rare larger fire origin for this ecosystem

The surrounding BLM fire perimeter data was not currently available until 2000 (Caplette pers. comm. 2008), which accounts for incomplete fire perimeter data in half of the analysis area. The occurrence of fire on the land has potential to affect or change the vegetation, other ecosystem members, and the trajectory or the pathway of succession on the land. Note that fire effects' severity (low to high severity effects upon the live vegetation, dead fuels, wildlife, and ground layers) was not used as an analysis variable because that information was not readily available for all fires that were considered.

Table 11 summarizes all known mapped fire perimeters for USFS fire history data 1924-2006 (mostly within or touching SMNRA boundaries) and BLM land from 2000-2007 in the analysis area. The amounts in Table 11 demonstrate that similar patterns in vegetation associations exist, as mentioned earlier, with the ignition types and the origin location of large fires. The blackbrush association accounted for 37% of mapped vegetation and 47% of all acres burned. The pinyon – juniper association accounted for 15% of mapped vegetation and 35% of all acres burned. The fire history in the creosote bush association (only 1% burned in entire area) could have been underrepresented due to mapping errors or recorded data, especially in comparison to being about 35% of the vegetation in the analysis area. All acres and percents were rounded to the nearest whole number unless the amount was less than 0.5.

Another pattern is the small percent of acres burned in the alpine, montane wash, and desert wash associations. Also noted is the small fire sizes documented by lightning ignitions in the bristlecone pine; this is demonstrated by Table 11 data, which lists only 2% of all burned acres and 2% of all mapped vegetation being bristlecone pine type. Note that an assumption was made that the amount of acres accounted for in the spatial analysis of vegetation underlying the recorded fire perimeters was greater than the project's analysis area due to the overlap of some fire boundaries accounting for some of the same acres twice. This analysis was limited in scope and did not specifically account for acres burned more than once over the mapped area.

Table 11. Summary of all known and mapped fire perimeters for USFS land in the analysis area, 1924-2006 and surrounding BLM land, 2000-2007; acreage per vegetation association within the fire perimeters.

Acres or percentage	Vegetation Association										
subtotal categories	**alpine**	**black-brush**	**bristle-cone pine**	**cliff and rock outcrop**	**creosote bush**	**desert wash**	**mixed shrubs**	**montane wash**	**pinyon-juniper**	**white fir - ponderosa pine**	**no veg. assign-ment**	**Total acres in analysis area**
total acres	455	435,396	23,584	54,729	414,206	507	17,433	1,413	176,873	36,054	10,810	1,171,462
total acres **unburned**	455	384,155	21,915	52,217	410,730	505	16,237	1,189	139,329	31,981	5,652	1,064,367
total acres **burned**	0	51,242	1,669	2,512	3,476	2	1,196	224	37,544	4,072	5,158	107,095
% **burned**	0%	12%	7%	5%	1%	0%	7%	16%	21%	11%	48%	9%
% **unburned**	100%	88%	93%	95%	99%	100%	93%	84%	79%	89%	52%	91%
% **burned** of veg. assoc./ all **burned** acres	0%	47%	2%	2%	3%	0%	1%	0%	35%	4%	5%	99%
veg assoc. % of entire area	0.04%	37%	2%	5%	35%	0.04%	1%	0.1%	15%	3%	1%	100%

Generalized Fire Regime Condition Class

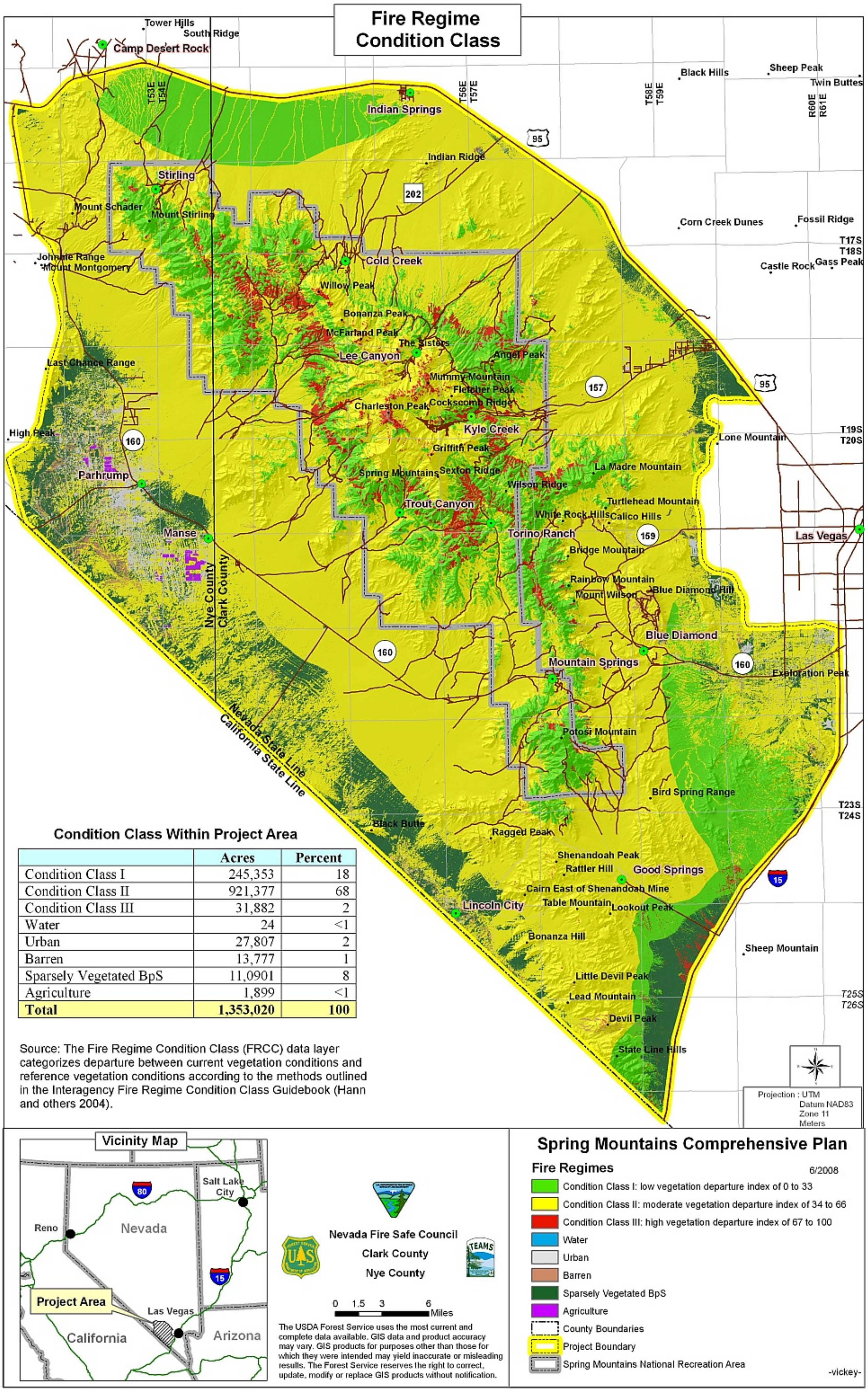
For spatial modeling purposes and as a tool for fire managers, the above fire regime condition classes have been *generalized* for the area using existing vegetative data.(see Figure 30) into the three-tier national landscape classification scheme describing the degree of departure in the current fire regime from the historic fire regime. The classification scheme is based on changes in vegetative characteristics, fuel composition, and fire frequency and intensity and described as low (I), moderate (II), or high (III) departure.

- **Low (I)** condition class means vegetative characteristics and fire behavior are considered to be within the historic range of variability.
- **Moderate (II)** condition class means vegetative characteristics and fire behavior are moderately altered from historic conditions.
- **High (III)** condition class means vegetative characteristics and fire behavior are highly altered and there is a risk of losing key ecosystem functions.

The majority of the analysis area is in Fire Regime condition class II. These are areas where fire behavior has been moderately altered and an intense fire could have significant impacts on the local ecosystem. Areas in condition class II are upper montane forests and alpine areas where historic fire return intervals were much longer than those in the lower montane forest.

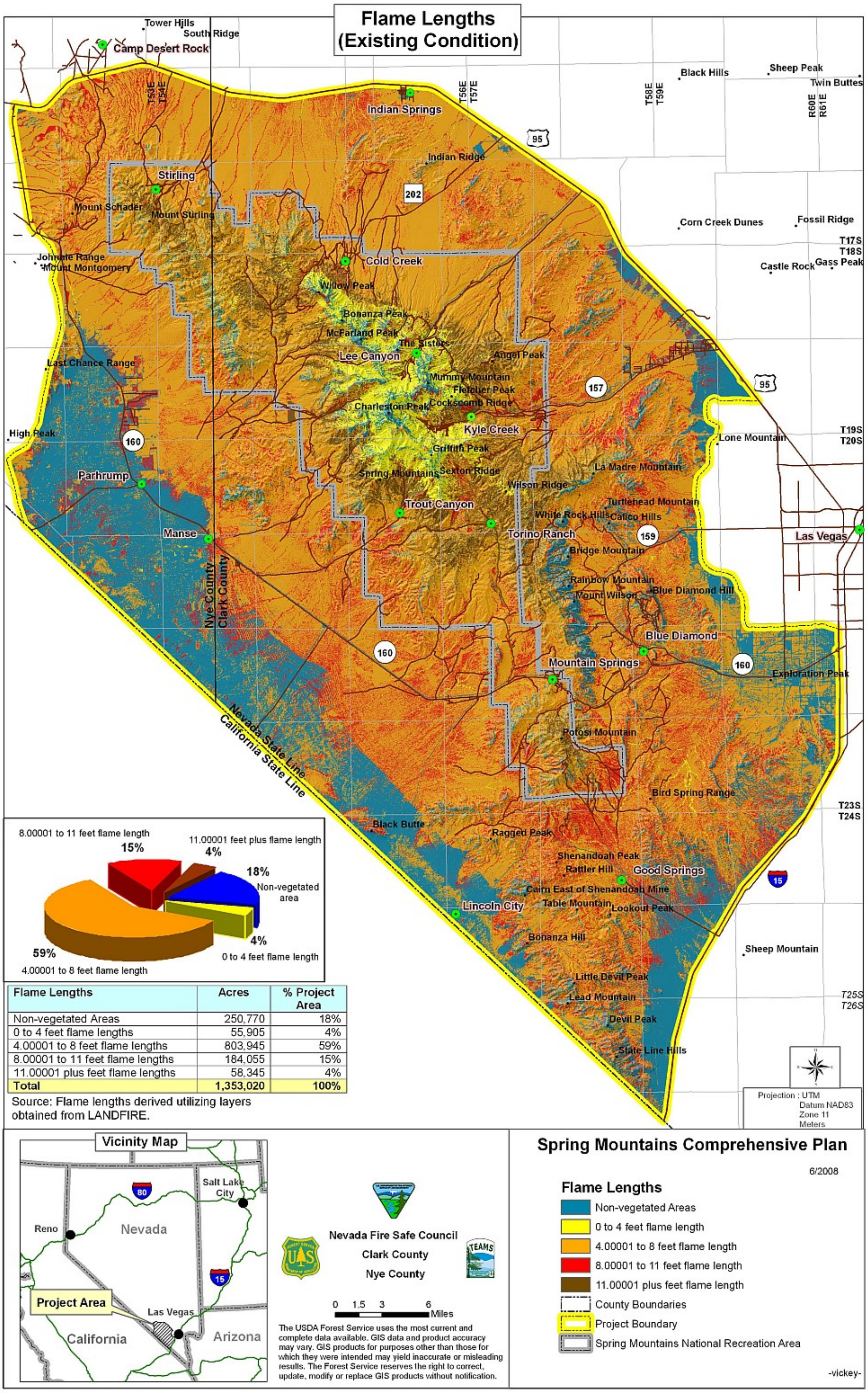
Current Wildfire Potential

Fire behavior modeling was conducted to evaluate fire behavior and risk in the analysis area. Fuels analyses, fire history (Figure 22) and fire behavior modeling were used to predict fire susceptibility in the analysis area. Wildfire potential based on FLAMMAP (Version 3.2, 2006), predicted fire behavior characteristics such as flame lengths and fire type. The model uses spatial information on topography and fuels along with weather and wind data. It incorporates existing models for surface fire, crown fire, and rate of spread. Predicted fire behavior outcomes were determined for the analysis area using local weather conditions. This analysis found that on normal high fire days (90^{th} percentile weather conditions) approximately 78 percent of fuel conditions in the Spring Mountains would have flame lengths exceeding 4 feet with approximately 5 percent of the area potentially developing into passive or active crown fire (Figure 26 and Figure 27) and approximately 78 percent of the area experiencing high-extreme rates of spread (Figure 28). Under these conditions, fire crews cannot use direct attack strategies and must rely on mechanized equipment and aerial support to suppress these fires. Under extreme fire weather conditions, these estimates would be worse.



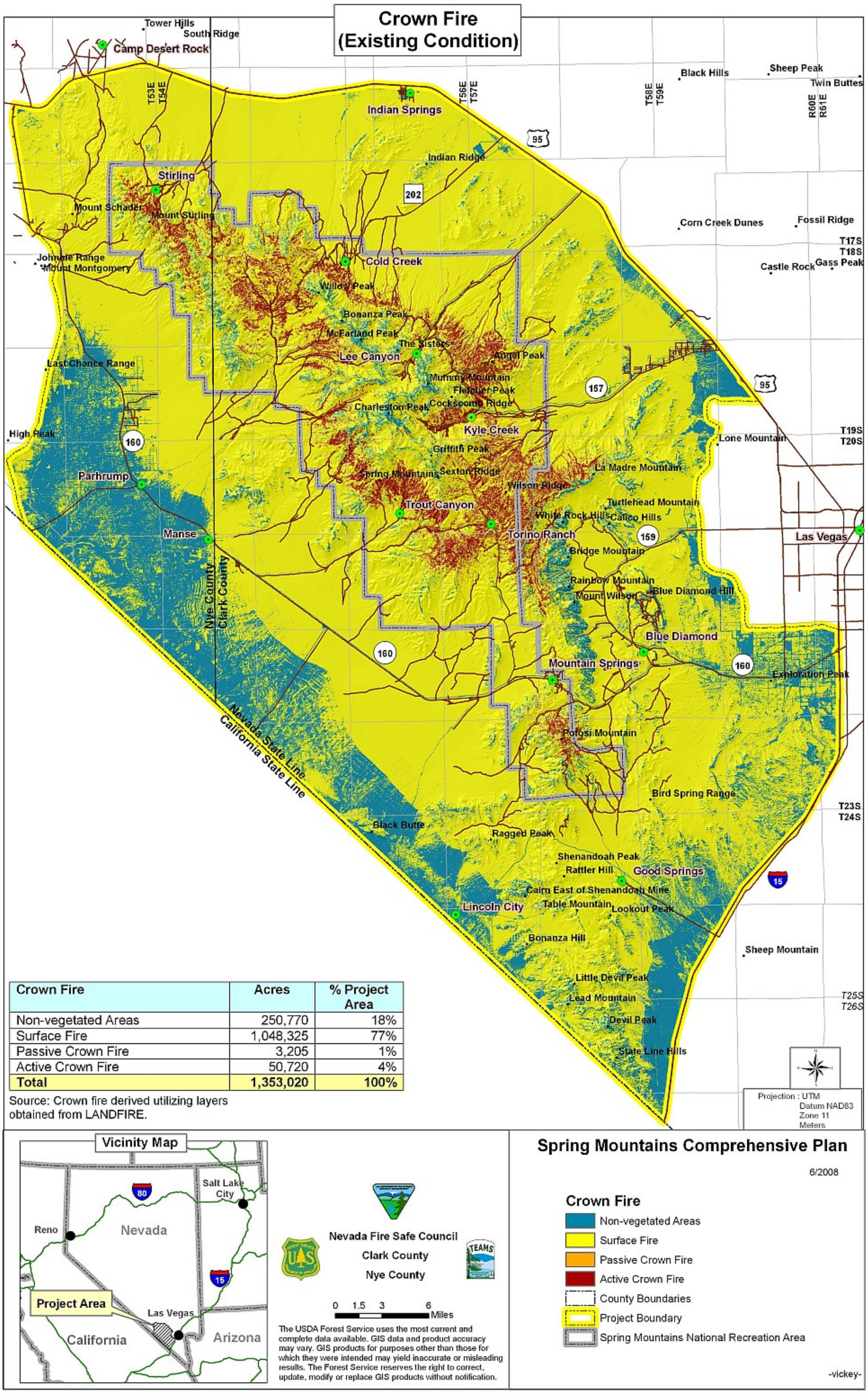
	Acres	Percent
Condition Class I	245,353	18
Condition Class II	921,377	68
Condition Class III	31,882	2
Water	24	<1
Urban	27,807	2
Barren	13,777	1
Sparsely Vegetated BpS	11,0901	8
Agriculture	1,899	<1
Total	**1,353,020**	**100**

Figure 25. Fire regime condition class



Flame Lengths	Acres	% Project Area
Non-vegetated Areas	250,770	18%
0 to 4 feet flame lengths	55,905	4%
4.00001 to 8 feet flame lengths	803,945	59%
8.00001 to 11 feet flame lengths	184,055	15%
11.00001 plus feet flame lengths	58,345	4%
Total	**1,353,020**	**100%**

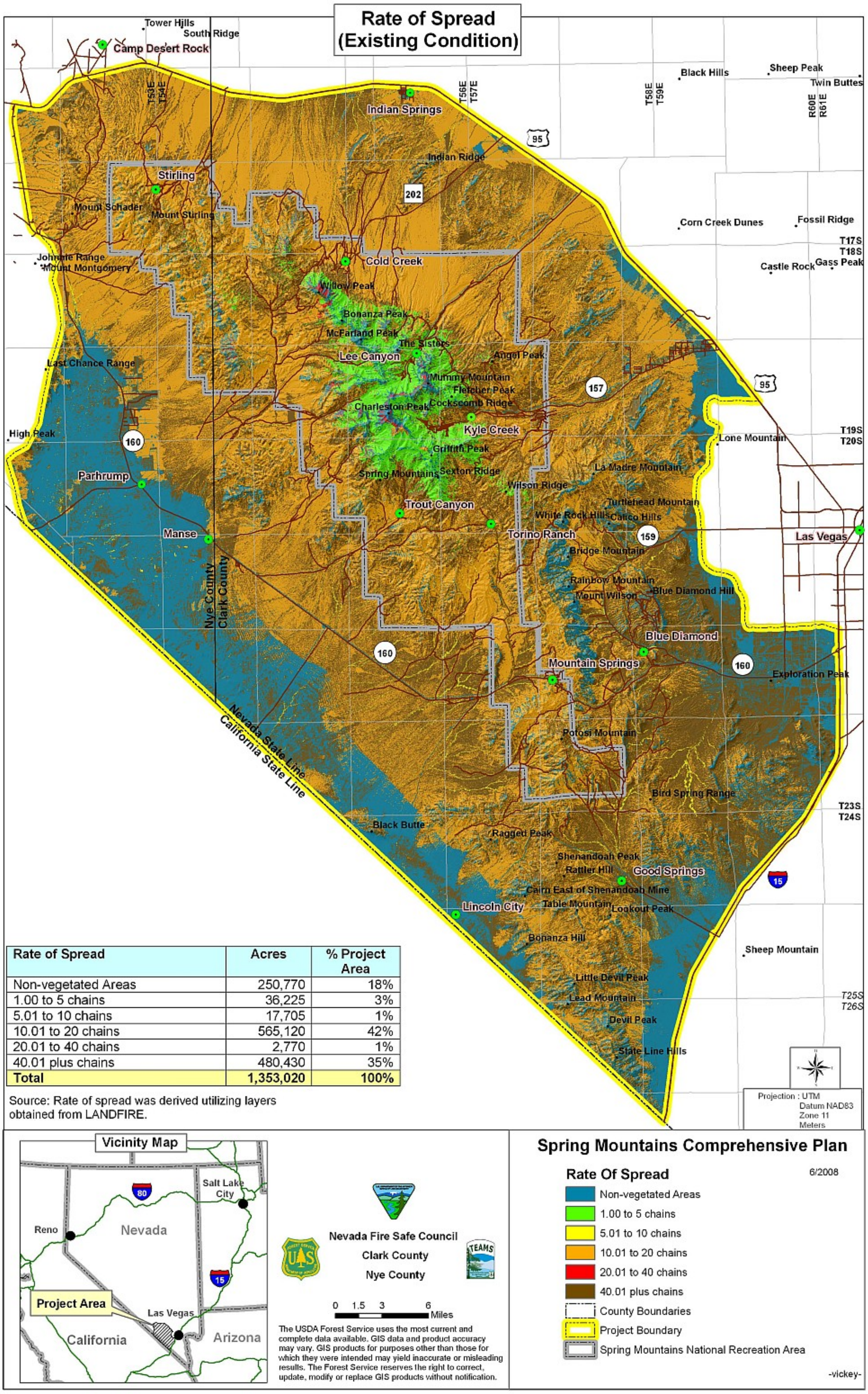
Figure 26. Potential flame lengths before treatments



Crown Fire	Acres	% Project Area
Non-vegetated Areas	250,770	18%
Surface Fire	1,048,325	77%
Passive Crown Fire	3,205	1%
Active Crown Fire	50,720	4%
Total	**1,353,020**	**100%**

Source: Crown fire derived utilizing layers obtained from LANDFIRE.

Figure 27. Existing potential for crown fire



Rate of Spread	Acres	% Project Area
Non-vegetated Areas	250,770	18%
1.00 to 5 chains	36,225	3%
5.01 to 10 chains	17,705	1%
10.01 to 20 chains	565,120	42%
20.01 to 40 chains	2,770	1%
40.01 plus chains	480,430	35%
Total	**1,353,020**	**100%**

Figure 28. Existing potential for rate of fire spread

Desired Conditions

The ultimate goal would be that disturbance by fire contributes to functioning ecosystems. Fire would be allowed to play its natural role where appropriate and desirable, but is suppressed where necessary to protect life and resources. Fire is used to manage vegetation, where appropriate, to enhance ecosystem resiliency and lower hazardous fuel levels.

The overriding goal for any fire management activity will always be firefighter and public safety. The Forest will encourage and participate in partnerships with citizens or community-centered approaches to manage fire risks and hazards in wildland-urban interface areas.

- Continue to identify high fire hazard areas in the wildland-urban interface areas.
- Develop and prioritize vegetation treatment plans in coordination with local and tribal government agencies and landowners to reduce the risk from wildland fire.
- Enhance public awareness of the fundamental importance of fire in the ecosystem.

The desired condition statements are goals that, when achieved, will trend current fire regime condition classes toward their historic norm and reduce fire behavior towards conditions where safe and effective fire suppression can be employed. Generally, this means reducing vegetation in proposed project areas toward historic levels (low [I] condition class), resulting in reduced fire behavior characteristics.

Table 12. Desired wildland fuel conditions

	Current Trend	Desired Trend
Fire Regime Condition Class	Moderate (II) to High (III)	Moderate (II) to Low (I)
Fire Behavior	Passive to Active Crown Fires with Flame Lengths that exceed 4 feet	Surface Fires with Flame Lengths less than 4 feet

Desired conditions for the planning area are derived from a variety of plans, including recommendations from CWPPs addressing communities. Fuel treatments on all federal lands will be consistent with the standards and guidelines identified in the Humboldt-Toiyabe National Forest Land and Resource Management Plan (1986). On all other land ownerships, fuel treatments will be consistent with the regulations, standards, and guidelines of the appropriate regulatory agencies. Desired vegetative conditions are described for the defense zone and threat zone where management direction and treatment objectives are clearly different.

Vegetation has been modified (interrupted) and a network of fuelbreaks are in place around communities, administrative sites, communications sites, campgrounds, special use areas and along road corridors improving community protection and enhancing public and firefighter safety.

Defense

The management objective in this zone is to protect communities. This zone is located near structures and high-valued areas such as communication sites. The objective is to reduce fire behavior characteristics to a surface fire, regardless of fire regime. The desired condition for defensible space on developed lots will be consistent with “Living with Fire (Nevada Living With Fire; Nevada Division of Forestry, Wildfire Protection Guide 1997, Smith 2004). In conifer forest types, predicted flame lengths will be less than 4 feet and preferably less than 2 feet, under 90th-percentile weather conditions. Crown base heights (height from the forest floor to the bottom most branches of the live tree crown) will be managed to avoid all crown fires. Crown cover of forest stands will average 40 to 60 percent to allow for adequate spacing between crowns and to reduce surface wind speeds and drying of surface fuels. In shrub types, predicted rates of spread will be reduced 50 percent of pretreatment simulated estimates.

Threat Zone

The management objective in this zone is to establish and maintain a pattern of treatments that are effective in modifying fire behavior. In conifer forest types, predicted flame lengths will generally be less than 4 to 6 feet; however, they may be higher in some locations. Crown base heights will be managed to avoid crown fires. Crown cover will vary and in some areas be less than 40 percent. Grasses and patches of shrubs will be abundant in conifer stands where flame lengths are currently 6 feet or greater. In shrub types, predicted rates of spread will be reduced to 50 percent of pretreatment simulated estimates. Maintenance treatments will keep these areas within the desired conditions.

General Forest

The general forest includes all other lands beyond the wildland-urban interface and below the alpine zone. The management objective in this zone is to establish a mosaic of treatments that are effective in modifying fire behavior. Many planned treatments will be adjacent to existing roads where crews and machines have ready access; therefore, changes in the current forest structure and fuel hazards will be in a mosaic, based primarily on access. Crown cover will vary and in some areas will be less than 40 percent. Grasses and patches of shrubs will be abundant in stands with less than 40 percent canopy cover. In conifer forest types, predicted flame lengths will be less than 4 to 6 feet immediately after treatment and crown base heights will be managed initially to avoid the threat of a passive crown fire. In shrub types, predicted rates of spread will be reduced to 50 percent of pretreatment simulated estimates. However, flame lengths will gradually increase in treated areas because little or no maintenance will occur in the general forest. Snags and coarse woody debris will continue to accumulate because of the lack of disturbance in most of this zone.

The desired conditions for pine and pine/fir mixed-conifer stands is for the stands to be composed of a mixture of tree species where appropriate, but to be dominated by the more fire-resistant ponderosa pine and Jeffrey pine species. The stands should have stocking levels sufficiently low to be considered “low” to only “moderate” risk to bark beetles, and bark beetle activity should be at an endemic level.

Predicted Outcomes

The existing fuel condition of the analysis area is in a state of moderate-high departure from historical and desired conditions. This condition dramatically increases the potential of a high-intensity surface fire transitioning into a crown fire. Community wildfire protection plans upon which this comprehensive plan is built identify key values that are at risk and the vegetative stands that do not meet the desired conditions that put those values at risk. Proposed projects included in this plan are or will be designed with prescriptions to meet the desired conditions.

General prescriptions are designed to reduce fire behavior to the extent defined in each of the zones defined in this plan. These prescriptions are based upon proven strategies, science, and principles such as those detailed in "Living with Fire" (Smith 2004). The design and priority of the treatments are focused on the wildland-urban interface and associated egress and transportation routes. Approximately 88,083 acres (7 percent) of the analysis area is proposed to be treated.

Based on review by wildland fire managers, the projects contained in the plan are expected to move wildland fuel conditions toward their desired fire regime condition class and fire behavior goals. Site-specific modeling of some project areas has confirmed this determination. Fire intensity and fire spread rate were modeled utilizing the FLAMMAP fire simulation program for multi-jurisdictional projects in the analysis area. Results from these simulations show a decrease in fireline intensity and fire spread where treatments are proposed (Figures 27-29)   More importantly, many of these treatments are focused in wildland-urban interface and defense areas; therefore the reduction in fire behavior is targeted at stands that will have the most meaningful results to firefighters and communities.   A close-up of modeled fire behavior is illustrated in Figures 24-26 showing post fire behavior predictions in the Kyle Canyon area.

Under this scenario, the outcomes of these combined treatments would meet the desired condition of reducing fire behavior and trending the area towards a lower fire regime condition class.

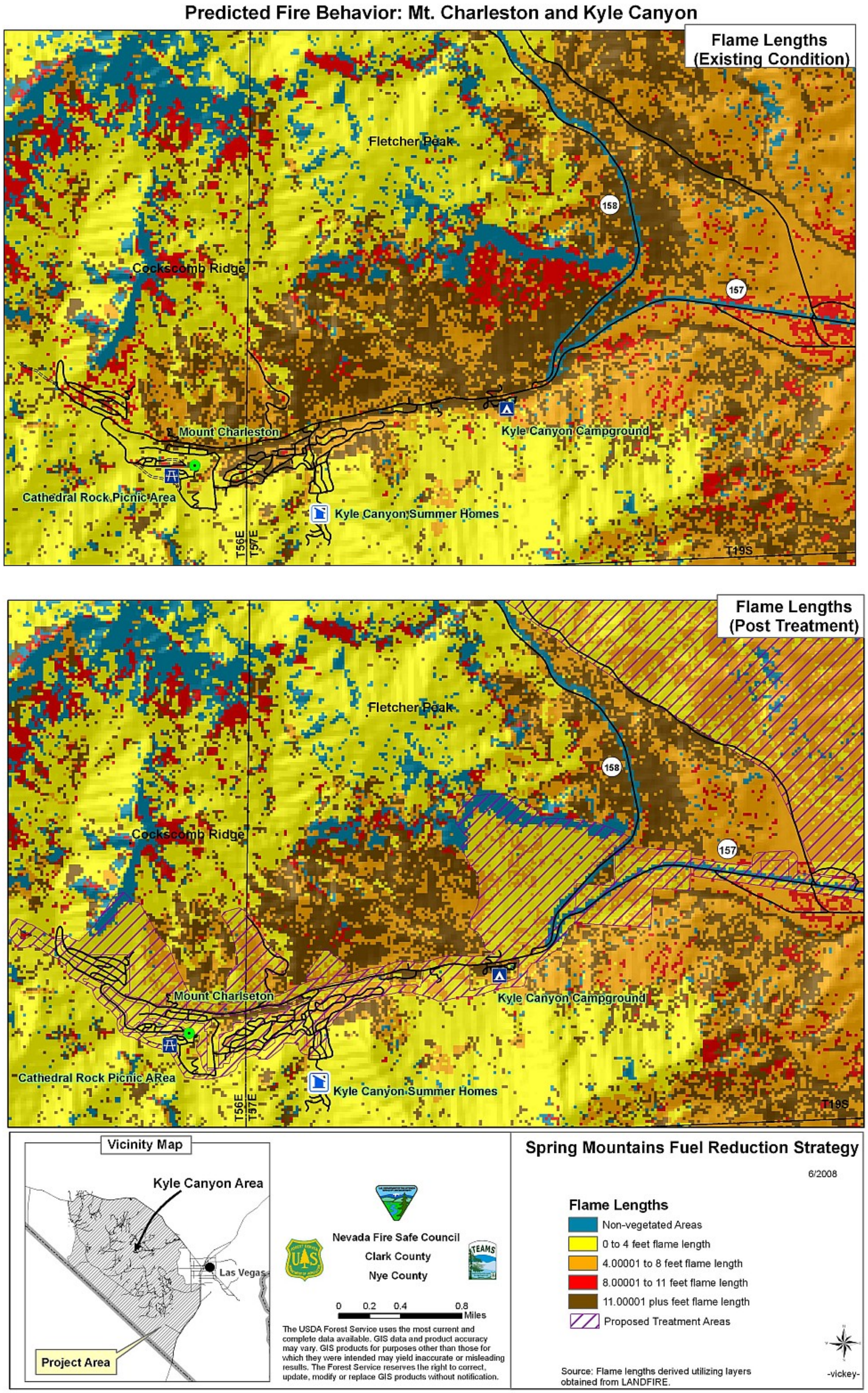


Figure 29. Modeled outcome for flame length in the Kyle Canyon area

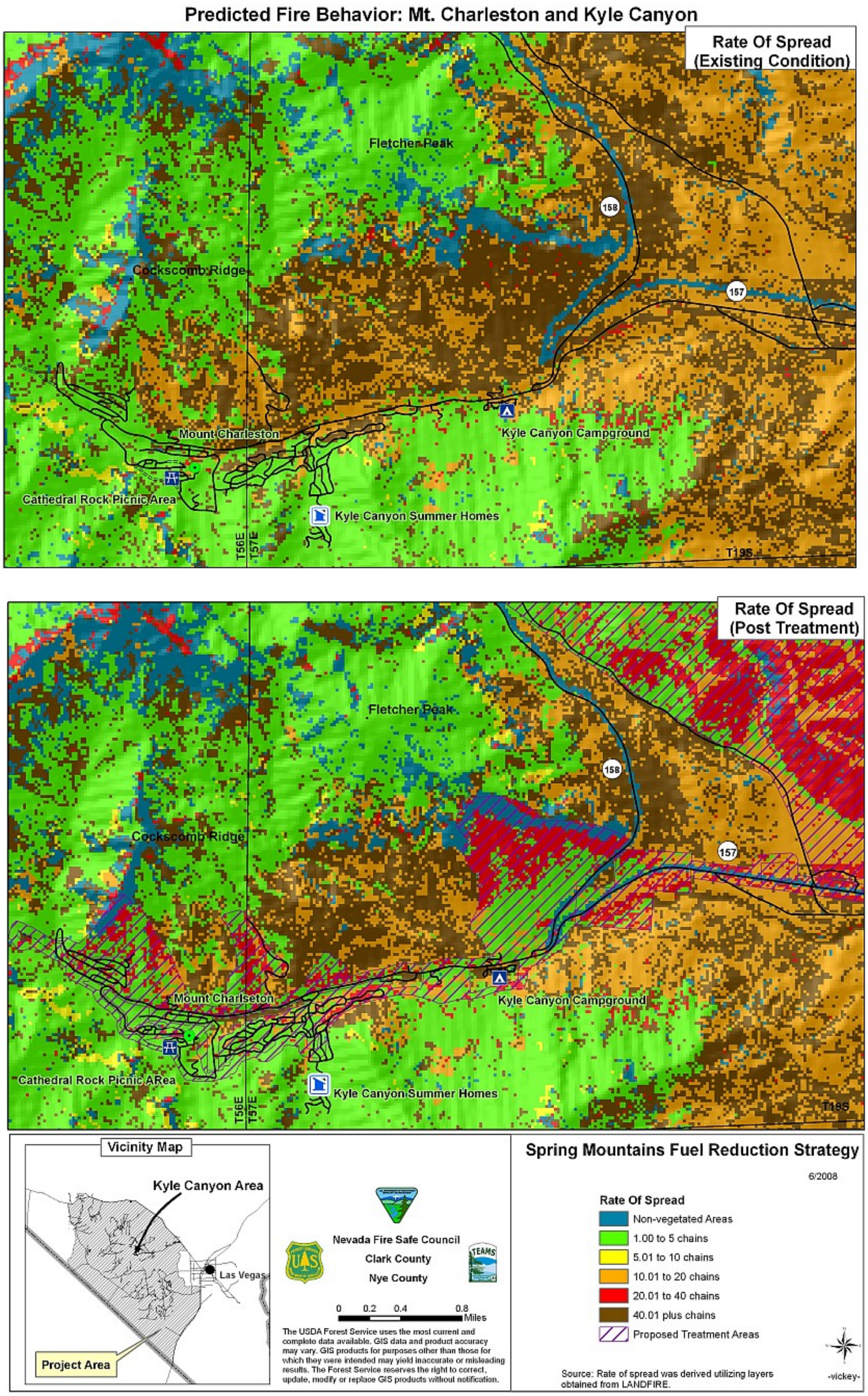


Figure 30. Modeled outcome for rate of spread in the Kyle Canyon area

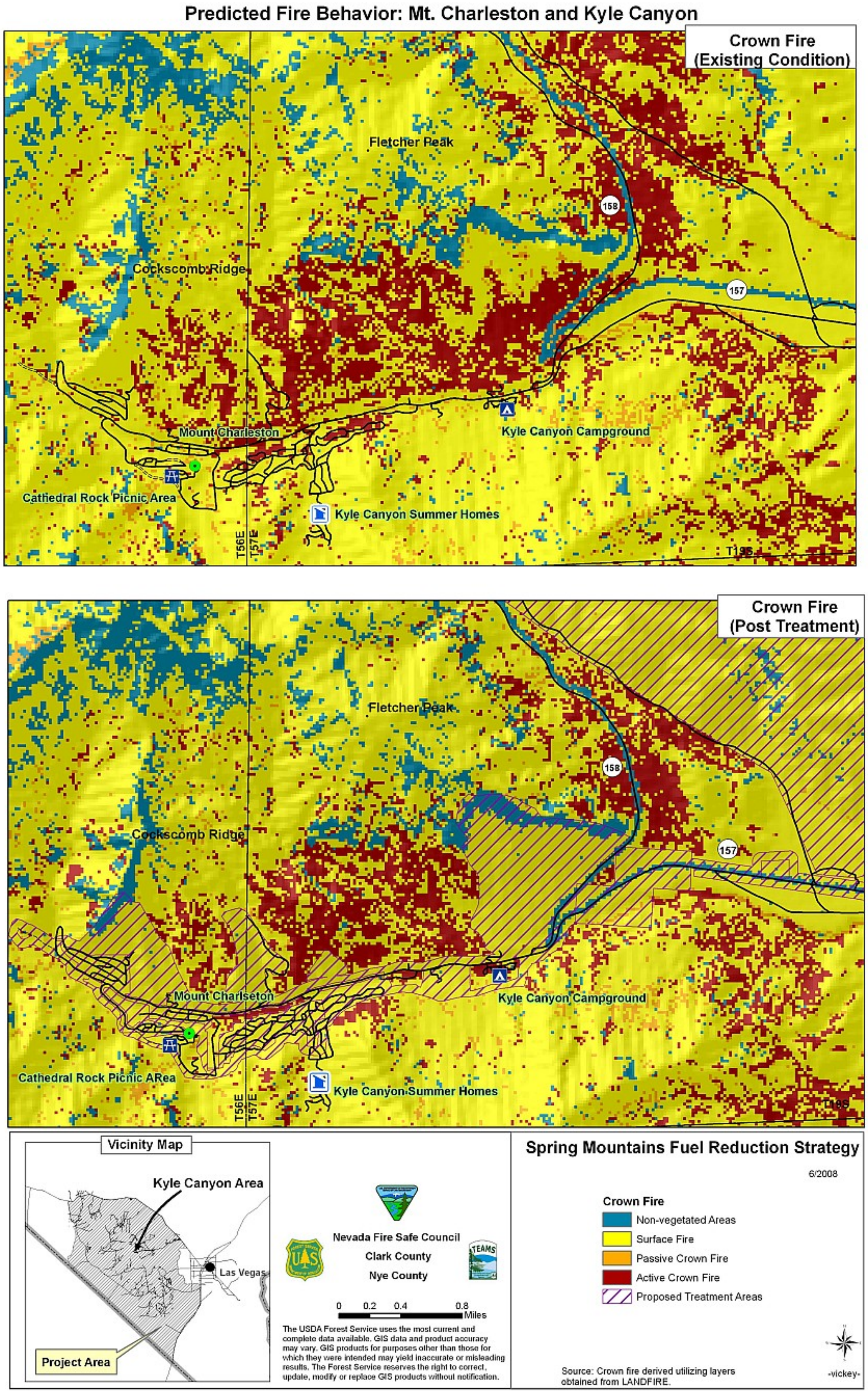
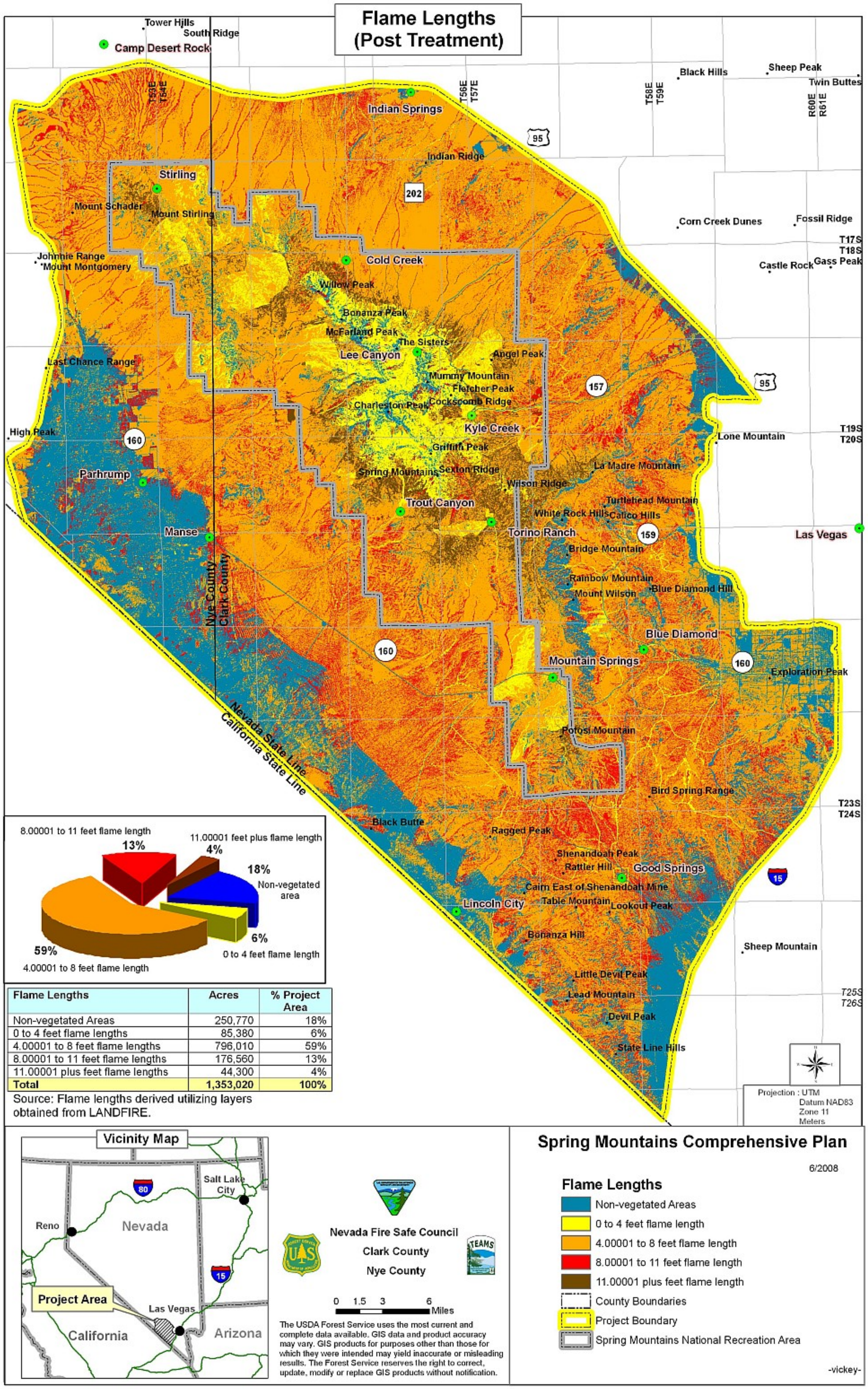


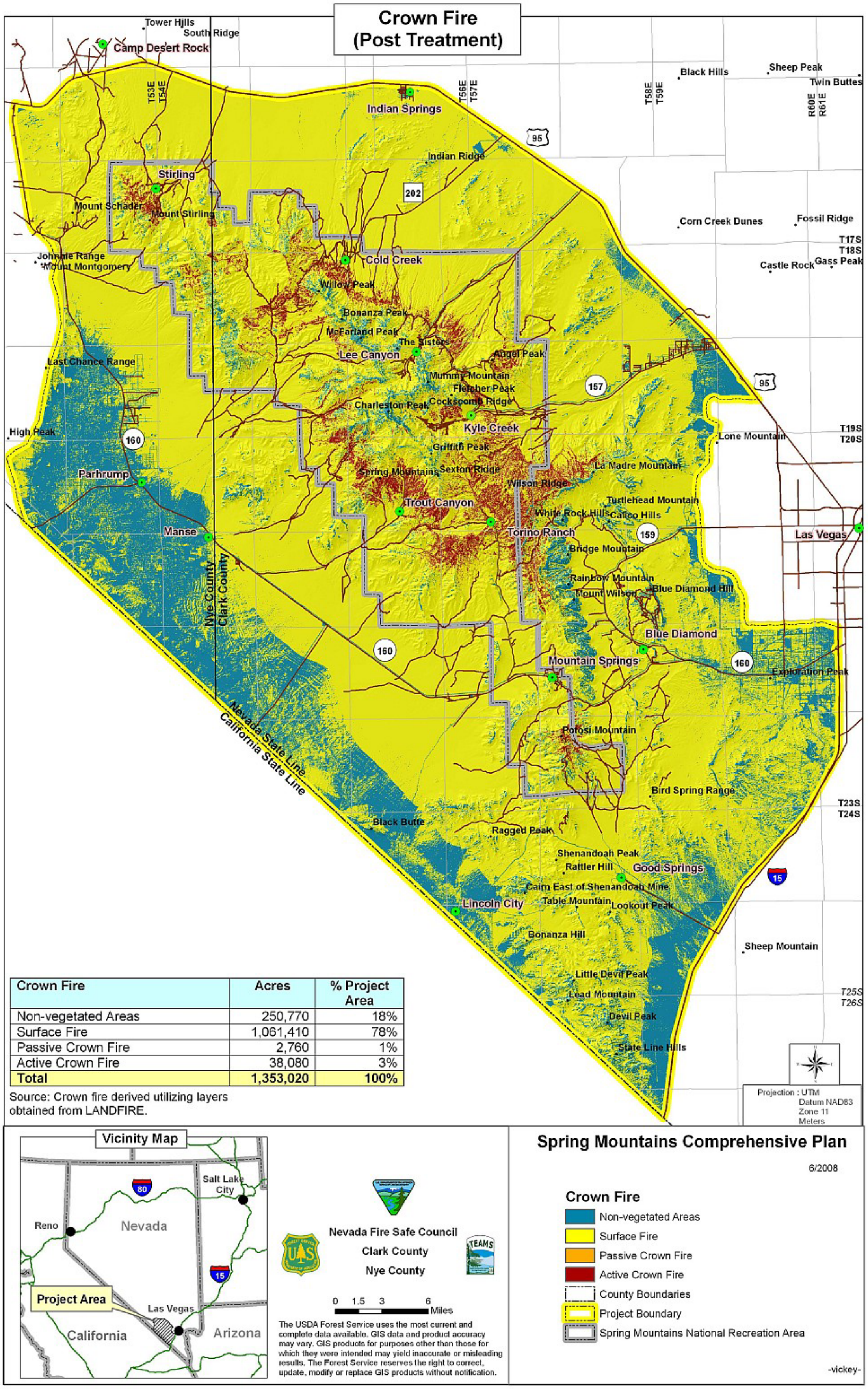
Figure 31. Modeled outcome for fire type in the Kyle Canyon Fire area



Flame Lengths	Acres	% Project Area
Non-vegetated Areas	250,770	18%
0 to 4 feet flame lengths	85,380	6%
4.00001 to 8 feet flame lengths	796,010	59%
8.00001 to 11 feet flame lengths	176,560	13%
11.00001 plus feet flame lengths	44,300	4%
Total	**1,353,020**	**100%**

Source: Flame lengths derived utilizing layers obtained from LANDFIRE.

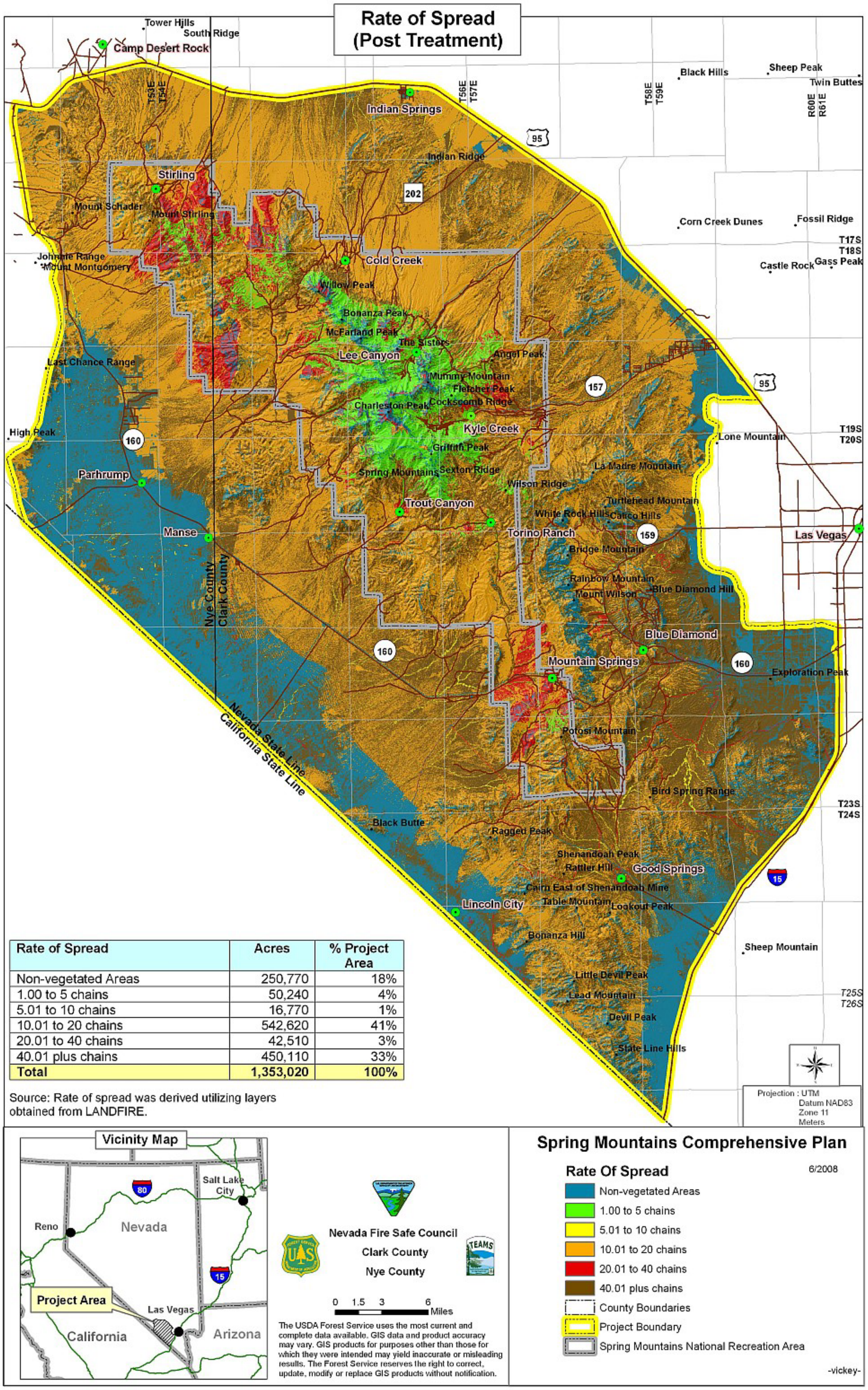
Figure 32. Predicted flame lengths following treatment



Crown Fire	Acres	% Project Area
Non-vegetated Areas	250,770	18%
Surface Fire	1,061,410	78%
Passive Crown Fire	2,760	1%
Active Crown Fire	38,080	3%
Total	**1,353,020**	**100%**

Source: Crown fire derived utilizing layers obtained from LANDFIRE.

Figure 33. Predicted crown fire following treatment



Rate of Spread	Acres	% Project Area
Non-vegetated Areas	250,770	18%
1.00 to 5 chains	50,240	4%
5.01 to 10 chains	16,770	1%
10.01 to 20 chains	542,620	41%
20.01 to 40 chains	42,510	3%
40.01 plus chains	450,110	33%
Total	**1,353,020**	**100%**

Figure 34. Predicted rate of spread following treatments

Section 8: Environmental Regulations and Compliance

All individual projects designed to reduce fuel hazards that are proposed by public agencies, funded by public agencies, or that require federal, state, local, or local discretionary approval will be subject to federal, state, or regional environmental regulations.

National Policies and Regulations

Several national policies and regulations guide wildland fire management. They include the National Fire Plan, 10-Year Comprehensive Strategy (USDI and USDA 2001); National Fire Plan 10-Year Comprehensive Strategy Implementation Plan (USDI and USDA 2002); Federal Wildland Fire Policy (USDI et al. 1995 [updated 2001]); Healthy Forests Restoration Act (2003); and Protecting People and Natural Resources: A Cohesive Fuels Treatment Strategy (USDI and USDA 2006). This plan is consistent with all of these policies and regulations, which are described below. In addition, all projects on National Forest System lands will need to be compliant with other federal laws and regulations such as the Endangered Species Act, the Clean Water Act, and the National Forest Management Act.

The National Fire Plan and 10-Year Comprehensive Strategy

The National Fire Plan was developed by the U.S. Department of the Interior and U.S. Department of Agriculture in 2000 to actively respond to severe wildland fires and their impacts to communities while ensuring sufficient firefighting capacity for the future. It provided direction for the identification of "communities at risk", which are located in the vicinity of federal lands where wildland fires have the potential to threaten adjacent private lands. Identifying communities at risk has assisted planning for fuel reduction projects on federal lands and increased awareness of wildfire threats in those communities.

National Environmental Policy Act

All fuel reduction projects funded by the federal government that occur on federal land (such as National Forest land), or require a federal agency to issue a permit, must comply with the National Environmental Policy Act (NEPA). The Act requires agencies to prepare environmental impact statements (EISs), environmental assessments (EAs), or categorical exclusions (CEs) to evaluate potential impacts of proposed projects on the quality of the human environment.

The Healthy Forest Restoration Act (H.R. 1904, December 2003)

The Healthy Forest Restoration Act (HFRA) simplified the NEPA process by limiting the range of alternatives that are required to be considered in an environmental document that involves fuel reduction or forest health projects designed to protect communities, watersheds, or endangered or threatened species from wildfire. HFRA also changed the USDA Forest Service administrative appeal process for NEPA decisions to a simpler objection process.

HFRA allows communities to designate their wildland-urban interface; authorizes fuel reduction projects on federal lands in the wildland-urban interface; requires federal agencies to consider recommendations made by communities at risk that have developed community wildfire protection plans, and gives funding priority to communities that have adopted community wildfire protection plans. EAs and EISs documenting HFRA-authorized projects may consider only one action alternative if that alternative meets certain wildland-urban interface criteria and implements the general actions of an applicable community wildfire protection plan.

Regional Policies and Regulations

Conservation Agreement For The Spring Mountains

The Conservation Agreement for Spring Mountains (CA) is a formal agreement outlining responsibilities for the Forest Service, USFWS, NDOW, and the State of Nevada Department of Conservation and Natural Resources (DCNR), in providing long-term protection for the rare flora and fauna of the Spring Mountains NRA. The DCNR involved in the implementation of the CA includes Nevada Division of Forestry, and Nevada Natural Heritage Program (NNHP). The CA is intended to reflect an ecosystem management approach to conservation of endemic and sensitive species.

Clark County Multiple Species Habitat Conservation Plan

In 2000, the Clark County Multiple Species Habitat Conservation Plan (MSHCP) was developed for Clark County and NDOT activities within specified areas with adjoining counties (RECON 2000). While allowing for the expansion of the municipal areas within Clark County, the goal of the MSHCP is providing for conservation and management of covered species and their habitats to prevent the need to list additional species. The majority of the Spring Mountains lies within Clark County; therefore, the majority of it is included in the scope of the MSHCP. The MSHCP incorporates the CA and many of the species of concern listed in the CA, 50 of the 57 species, were brought forward into the MSHCP and are now covered by the permit issued for the MSHCP.

Nevada Division of Forestry NRS 528

NRS 528 regulates forest practices and reforestation on private and state lands in Nevada.

Nevada Revised Statutes 472.041

NRS 472.041 is the enforcement of certain provisions of Uniform Fire Code regarding clearance of vegetation around structures.. It should be noted that enforcement of these provisions can only be accomplished to the extent that funding and manpower of responsible agencies allow.

Agency Regulatory Responsibility

Several land management and regulatory agencies are responsible for complying with and enforcing regulations in the planning area. They include the USDA Forest Service Humboldt-Toiyabe National

Forest, Nevada Division of Forestry, local Fire Protection Districts, and the Tahoe Regional office of the Nevada Fire Safe Council.

Land Management Agencies

Toiyabe National Forest Land Management Plan - Spring Mountains NRA General Management Plan

The Spring Mountains NRA Act (PL-103-63) of 1993, the General Management Plan (GMP) for the Spring Mountains NRA an Amendment to the Land and Resource Management Plan, Toiyabe National Forest (1996), the Spring Mountains CA (1998), and the MSHCP (which has incorporated the CA) are the documents referenced when accomplishing the management goals (see Introduction) of the Spring Mountains NRA by the Forest Service.

Bureau of Land Management – Las Vegas Resource Management Plan and General Management Plan for the Red Rocks National Conservation Area.

The Las Vegas Resource Management Plan provides a comprehensive framework for managing approximately 3.3 million acres of public land administered by the Las Vegas Field Office of the Bureau of Land Management. The General Management Plan for the Red Rocks National Conservation Area (1999) supplements the Las Vegas Resource Management Plan for management activities with the Red Rocks NCA

Nevada Division of Forestry

The Nevada Division of Forestry manages all forestry, nursery, endangered plant species, and watershed resource activities on certain public and private lands within the Range. The Division also provides fire protection of structural and natural resources through fire suppression and prevention programs and other emergency services. The Nevada Division of Forestry is responsible for enforcing Nevada Revised Statutes (NRS) 528.

Regulatory Agencies

Nevada Department of Environmental Protection

Nevada Department of Environmental Protection plays a role in air and water quality in the Spring Mountains. Land management agencies are required to apply for a burn permit when burning in Clark and Nye Counties. In addition, the Washoe County District Health Department is involved with the burn permit process in the Washoe County. MOUs with these agencies require Nevada land management agencies to follow their guidelines and regulations in smoke management.

Section 9: Public Education and Wildfire Prevention Plans

Partnerships with the visitors and residents of the Spring Mountains are essential for the success of this strategy. The Nevada Fire Safe Council plays a key role linking land resource managers and wildfire suppression agencies with the communities of Spring Mountains, Recognizing this the planning cadre have proposed a series of outreach programs and actions relating to managing wildfire in the Spring Mountains. They include:

- Increasing in school fire education programs
- Attend community Fire Safe Council and Town board Meetings to advise of current fuels reduction projects
- Enforce fire restrictions
- Provide presentations of defensible space in each effected community of the Spring Mountains
- Sponsor collaborative yard and debris clean ups
- Develop fuel reduction demonstration projects
- Work with local Fire Safe Councils to contact absentee land owners and facilitate fuels reduction work on their lands.

In addition the partners will continue the following actions that are already in implemented:

Fire Prevention Plans: To various extents, each cooperating agency has developed a wildfire prevention plan. For example, the USDA Forest Service has developed a comprehensive prevention plan that focuses on education, detection, engineering, and enforcement. This plan details patrolling, media outreach, public education, and annual public events that the Forest actively supports. The plan is currently implemented by a dedicated prevention staff that includes three fire prevention technicians and a fire management staff.

One-on-One Contacts: All of the local fire agencies and the Nevada Fire Safe Council provide staff that meets with individual residents during defensible space inspections and during subsequent clearing operations. While these contacts are time consuming and inefficient, they may be the most effective because they are focused and result in the desired effect. Additionally, these organizations also provide free literature to residents, with the most common being, “Living with Fire – A Guide for the Homeowner”. This handout was developed by the University of Nevada Cooperative Extension, with more than two million copies printed.

Community Events: All of the federal, state, and local agencies participate in demonstrations and community events, including several sponsored by the Nevada Fire Safe Council, which developed and nurtured Fire Safe Chapters in individual communities throughout the Spring Mountains. These chapters are instrumental in encouraging individuals in those communities to actively participate in defensible space clearing and establishing fuelbreaks adjacent to communities.

Websites and Public Service Announcements: The majority of the local fire agencies and Nevada Fire Safe Council host websites that offer extensive information on defensible space inspections, defensible space requirements, free chipping services to dispose of hazardous fuels, and links to other sources of information. The most common link is to http://www.livingwithfire.info, a multi-agency sponsored website that provides extensive information on what residents should do before, during, and after a wildland fire. All of the agencies also support and participate in public service announcements that focus on defensible space requirements and public safety.

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Appendix A – Biomass Federal/State Policies

The following federal and state policies and resolutions have been developed to support the development of a biomass facility(s) in or near the Spring Mountains.

- The Healthy Forest Restoration Act of 2003 (H.R. 1904) encourages the accelerated adoption of technologies that use biomass and the establishment of small-scale business enterprises that make use of biomass (Title 3, Section 202).
- The Federal Energy Act of 2005 (P.L. 109-190) authorized the appropriation of federal subsidies for biomass development for a 10-year period (2006-2016). Specifically, it provides grants not to exceed $20 per green ton (GT) of biomass to current operators of biomass facilities and grants for developing or researching biomass opportunities.
- The Western Governor's Association adopted a resolution, the Clean and Diversified Energy Initiative, to develop 30,000 megawatts (MW) of clean and diverse energy by 2015 and accepted a set of recommendations to implement that recommendation in June 2006.
- California and Nevada passed renewable portfolio standards requiring energy producers and suppliers to include 20 percent and 15 percent, respectively, of renewable energy in the mix of available energy provided in those states.
- The Nevada Legislature's Task Force on Renewable Energy approved a resolution encouraging the beneficial use of biomass, which will be forwarded for adoption during the 2007 legislative session.
- In April 2006, Governor Schwarzenegger signed an Executive order reaffirming the 20 percent target for energy production and directed the Resources Agency and Energy Commission to coordinate efforts among state agencies to promote the use of biomass.
- In February 2007, Governor Gibbons signed an executive order supporting development of renewable energy and focusing on streamlining the permitting process.
- The USDA Forest Service recently drafted a woody biomass utilization strategy that focuses on providing sustainable supplies of materials, empowering entrepreneurial partnerships, using the best science and technology, and effective marketing (USDA Forest Service, January 9, 2007).

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Appendix C – Cooperating Agency Letters of Support