Chapter 1

Introduction

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Background

Many areas throughout the United States are facing the triple threat of increasing fire severity, residential growth in areas prone to wildland fire, and suppression costs and losses. In addition, substantial changes are occurring in the way we plan and implement management on federal lands relative to use of wildland fire, prescribed fire, and mechanical fuel management. Past emphasis in fire management has been on wildfire suppression and prescribed fire in support of other resources such as hazard reduction and site preparation in harvested areas and wildlife habitat improvement. Federal financial support has only recently supported the large-scale use of prescribed burning and mechanical fuels treatments to reduce unnatural fuel accumulations in non-wilderness areas.

The Southern Utah Fuel Management Demonstration Project was an effort to develop, evaluate, and compare methods to incorporate wildland fuels management into landscape scale land use planning processes for approximately 5.3 million ha (13 million acres) of southern Utah and 0.8 million ha (2 million acres) of northern Arizona (Ryan and Long 2004). This area was chosen because it is at an ecological crossroads for much of the western United States. It contains steep environmental gradients and a broad range of fuels and fire regimes associated with vegetation types representative of the Rocky Mountains, the Great Basin, and the Mohave Desert. The project developed GIS data layers for fuels, vegetation, and terrain that provided the inputs necessary to conduct fire behavior, fire effects, and succession modeling analyses. Several fuel treatments were also implemented at a variety of scales in the project area to demonstrate the use of fire behavior models for fuel treatment planning (Long and others 2003; Mathews 2003; Stratton 2004).

Project Objectives

This literature synthesis provides an ecological context for the larger Southern Utah Fuel Management Demonstration Project. The synthesis reviews the pertinent literature to address 1) historical conditions, 2) current conditions, 3) fire regime condition classes, and 4) recommended treatments for each of the major ecosystems found in the Southern Utah study area. Sections are by ecosystems and include: 1) coniferous forests (ponderosa pine, mixed conifer, and Engelmann spruce-subalpine fir), 2) aspen, 3) pinyon-juniper, 4) big and black sagebrush, and 5) desert shrubs (creosotebush, blackbrush, and interior chaparral).

Historical conditions are described in terms of characteristic species composition, structure, size class, age distribution, and fuel complexes that existed in presettlement times. In addition, disturbance frequency, size, and severity of historical disturbance regimes are discussed. Authors also address the ways disturbance historically affected community characteristics and position on landscape.

Current conditions of each focus ecosystem are then compared to historical. Current fuel condition descriptions may include additional information on amount of downed wood, amount of live and dead shrub and herbaceous fuels, annual production, range of annual variation caused by weather, and production relative to dominant life form. Where appropriate, authors also address changes in hydrologic function, such as streamflow, water yield, sediment production, and the potential effects of fire. Current disturbances are also described, including fire and fire suppression, insects, disease, ungulates (domestic and wildlife), exotic plants, patterns and frequencies of disturbances, as well as the resilience of each ecosystem to disturbance.

Each chapter includes a Fire Regime Condition Class (FRCC) (Schmidt and others 2002) assessment of the

ecosystem with descriptions of each condition class's characteristics within that particular ecosystem and an estimate of the area currently categorized as FRCC 1, 2, or 3. Authors address the key components that are at risk of being lost if a wildfire were to occur under current conditions. Moreover, authors recommend treatments for each ecosystem by condition class and describe treatments in terms of timing and season, the scale of the treatment, and pre- and post-treatment management considerations.

Study Area

The Southern Utah Demonstration Area roughly encompasses the southern 15 percent of Utah and consists of contiguous state and federal lands within the administrative boundaries of the Bureau of Land Management (BLM), Fishlake and Dixie National Forests, National Park Service, and state of Utah (fig. 1). Dominant vegetation types found in the demonstration area include various associations of pinyon-juniper, ponderosa pine, sagebrush-grass, aspen, spruce-fir, interior chaparral, and desert shrubs (fig. 2). These vegetation types are similar in species composition, stand structure, and ecologic function to vegetation types found on hundreds of millions of hectares in western United States.

Fire Regime Conditions Classes

A fire regime condition class (FRCC) is a classification of the amount of departure from the historical natural fire regime (Hann and Bunnell 2001). Coarse-scale FRCC classes were first defined and mapped by Hardy and others (2001) and Schmidt and others (2002). They are a metric for reporting the number of hectares in need of hazardous fuel reduction and evaluating the efficacy of wildland fuel treatment projects (Rollins and others 2006). This departure results in changes to one or more of the following ecological components: vegetation characteristics (species composition, structural stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated disturbances (for example, insect and diseased mortality, grazing, and drought) (Hann and others 2004).

FRCC stratifies three condition classes by five natural historical fire regimes. A natural fire regime is a general classification of the role fire would play across a

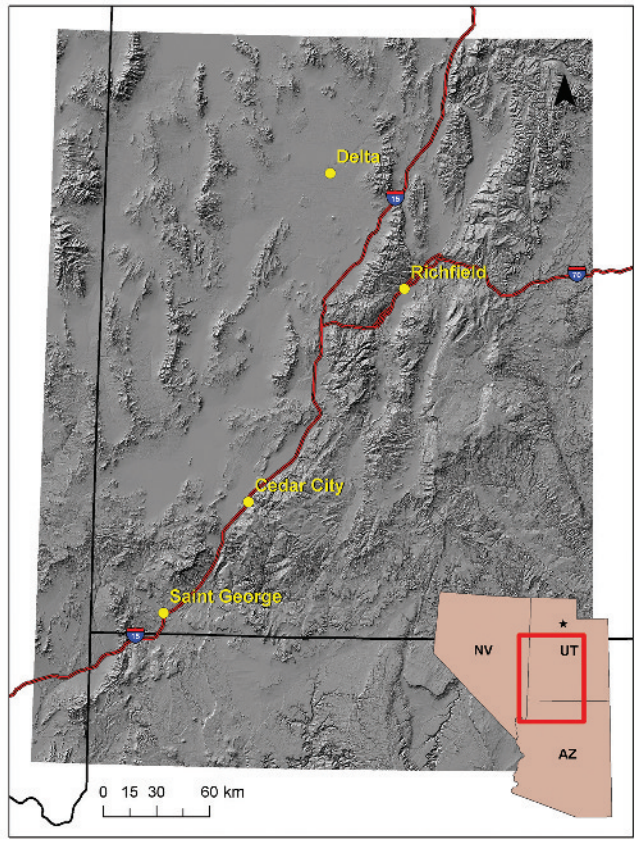

Figure 1—Southern Utah Fuel Management Demonstration Area location.

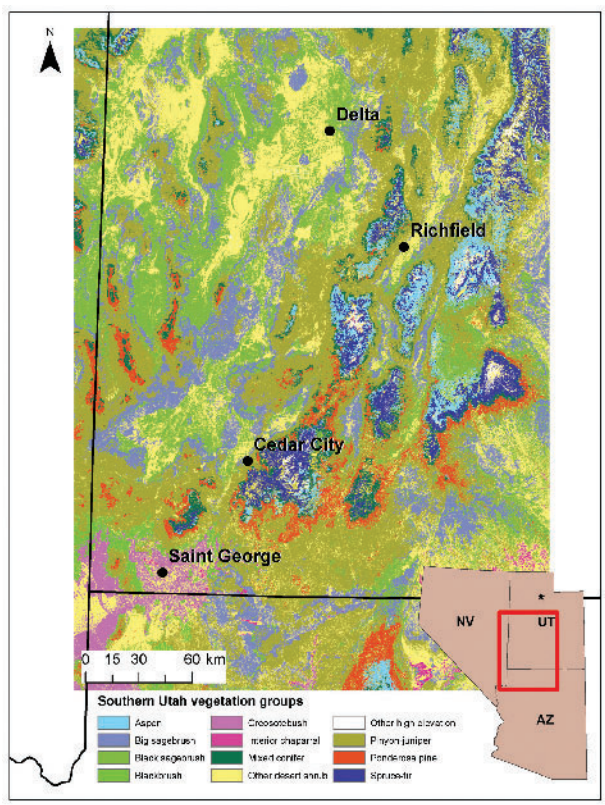

Figure 2—Major vegetation groups in southern Utah project area.

landscape in the absence of modern human mechanical intervention, but includes the influence of aboriginal burning. The five natural historical fire regimes are classified based on average number of years between fires (fire frequency) combined with the severity (amount of replacement) of the fire on the dominant overstory vegetation (table 1) (Hann and others 2004).

The three conditions classes are based on low (FRCC 1), moderate (FRCC 2), and high (FRCC 3) departure from the central tendency of the natural historical fire regime (table 2) (Hann and Bunnell 2001; Hardy and others 2001; Schmidt and others 2002). Low departure (FRCC 1) describes fire regimes and successional status operating within the historical range of variability. FRCC 2 and FRCC 3 characterize conditions outside the historical range (Rollins and others 2006). Characteristic vegetation and fuel conditions are those that occurred within the natural fire regime. Uncharacteristic conditions are those that did not occur within the natural fire regime, such as invasive species, "high graded" forest composition and structure, or repeated annual grazing that maintains grassy fuels across relatively large areas at levels that will not carry a surface fire. Determination of amount of departure is based on comparing a composite measure of fire regime attributes (vegetation characteristics; fuel composition; fire frequency, severity, and pattern) to the central tendency of the natural (historical) fire regime. The amount of departure is then classified to determine the fire regime condition class (table 3) (Hann and others 2004). Additional FRCC information can be found at http://www.frcc.gov/ (Hann and others 2003).

Management Implications

This literature synthesis provides land managers and planners in southern Utah and surrounding areas with the current state of knowledge of the dominant ecosystems in

Table 1—Natural (historical) fire regime classes from Hann and Bunnell (2001) for modeling landscape dynamics in the lower 48 States. Historical Range of Variability (HRV)–the variability of regional or landscape composition, structure, and disturbances during a period of time of several cycles of the common disturbance intervals and similar environmental gradients prior to extensive agricultural or industrial development.

Fire regime class	Frequency (Fire return interval, in years)	Severity	Modeling assumptions
I	Frequent (0 to 35)	Low	Open forest or savannah structures maintained by frequent fire; also includes frequent mixed severity fires that create a mosaic of different age post-fire open forest, early to mid-seral forest structural stages, and shrub or herb dominated patches (generally < 40 ha [100 acres]).
II	Frequent (0 to 35)	Stand replacement	Shrub or grasslands maintained or cycled by frequent fire; fires kill non-sprouting shrubs such as sagebrush, which typically regenerate and become dominant within 10 to 15 years; fires remove tops of sprouting shrubs such as mesquite and chaparral, which typically resprout and dominate within 5 years; fires typically kill most tree regeneration such as juniper, pinyon pine, ponderosa pine, Douglas-fir, or lodgepole pine.
III	Less frequent (35 to 100)	Mixed	Mosaic of different age post-fire open forest, early to mid-seral forest structural stages, and shrub or herb dominated patches (generally < 40 ha [100 acres]) maintained or cycled by infrequent fire.
IV	Less frequent (35 to 100)	Stand replacement	Large patches (generally > 40 ha [100 acres]) of similar age post-fire shrub or herb dominated structures, or early to mid-seral forest cycled by infrequent fire.
V	Infrequent (> 100)	Stand replacement	Large patches (generally > 40 ha [100 acres]) of similar age post-fire shrub or herb dominated structures, or early to mid to late seral forest cycled by infrequent fire.

Table 2—Condition classes from Hann and Bunnell (2001) for modeling landscape dynamics and departure from historical natural range of variability for the lower 48 States. Historical Range of Variability (HRV)–the variability of regional or landscape composition, structure, and disturbances, during a period of time of several cycles of the common disturbance intervals and similar environmental gradients prior to extensive agricultural or industrial development.

Condition class	Departure from HRV	Description
Class 1	None, minimal, low	Vegetation composition, structure, and fuels are similar to those of the historic regime and do not pre-dispose the system to risk of loss of key ecosystem components. Wildland fires are characteristic of the historical fire regime behavior, severity, and patterns. Disturbance agents, native species habitats, and hydrologic functions are within the historical range of variability. Smoke production potential is low in volume.
Class 2	Moderate	Vegetation composition, structure, and fuels have moderate departure from the historic regime and predispose the system to risk of loss of key ecosystem components. Wildland fires are moderately uncharacteristic compared to the historical fire regime behaviors, severity, and patterns. Disturbance agents, native species habitats, and hydrologic functions are outside the historical range of variability. Smoke production potential has increased moderately in volume and duration.
Class 3	High	Vegetation composition, structure, and fuels have high departure from the historic regime and predispose the system to high risk of loss of key ecosystem components. Wildland fires are highly uncharacteristic compared to the historical fire regime behaviors, severity, and patterns. Disturbance agents, native species habitats, and hydrologic functions are substantially outside the historical range of variability. Smoke production potential has increased with risks of high volume production of long duration.

Table 3—A simplified description of the fire regime condition classes and associated potential risks (Hann and others 2003).

Fire regime condition class	Description	Potential risks
Condition Class 1	Within the natural (historical) range of variability of vegetation characteristics; fuel composition; fire frequency, severity and pattern; and other associated disturbances.	Fire behavior, effects, and other associated disturbances are similar to those that occurred prior to fire exclusion (suppression) and other types of management that do not mimic the natural fire regime and associated vegetation and fuel characteristics. Composition and structure of vegetation and fuels are similar to the natural (historical) regime. Risk of loss of key ecosystem components (for example, native species, large trees, and soil) is low.
Condition Class 2	Moderate departure from the natural (historical) regime of vegetation characteristics; fuel composition; fire frequency, severity and pattern; and other associated disturbances.	Fire behavior, effects, and other associated disturbances are moderately departed (more or less severe). Composition and structure of vegetation and fuel are moderately altered. Uncharacteristic conditions range from low to moderate. Risk of loss of key ecosystem components is moderate.
Condition Class 3	High departure from the natural (historical) regime of vegetation characteristics; fuel composition; fire frequency, severity and pattern; and other associated disturbances.	Fire behavior, effects, and other associated disturbances are highly departed (more or less severe). Composition and structure of vegetation and fuel are highly altered. Uncharacteristic conditions range from moderate to high. Risk of loss of key ecosystem components is high.

the area. The review of historical and current conditions highlights how post-European settlement has changed the southern Utah landscape and the problems facing land managers today. The FRCC sections are intended as a general overview of ecosystems conditions. They should not be used to determine actual fire regime conditions in a given area. The Interagency Fire Regime Condition Class Guidebook and other tools are designed for assigning specific fire regime condition classes (Hann and others 2004, www.frcc.gov).

The recommended treatment sections include the commonly used methods to treat areas for fuel accumulation, exotic weed control, and other objectives. New methods, such as mastication, are always emerging to provide managers with more treatment alternatives. Research of these treatments will be necessary to improve our understanding of their effects on the ecosystems. With an understanding of the ecosystems and their responses to treatments and accurate spatial data on fuels, vegetation, fire regimes, and values, we can develop collaborative strategies for managing fuels in southern Utah on a landscape basis.

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