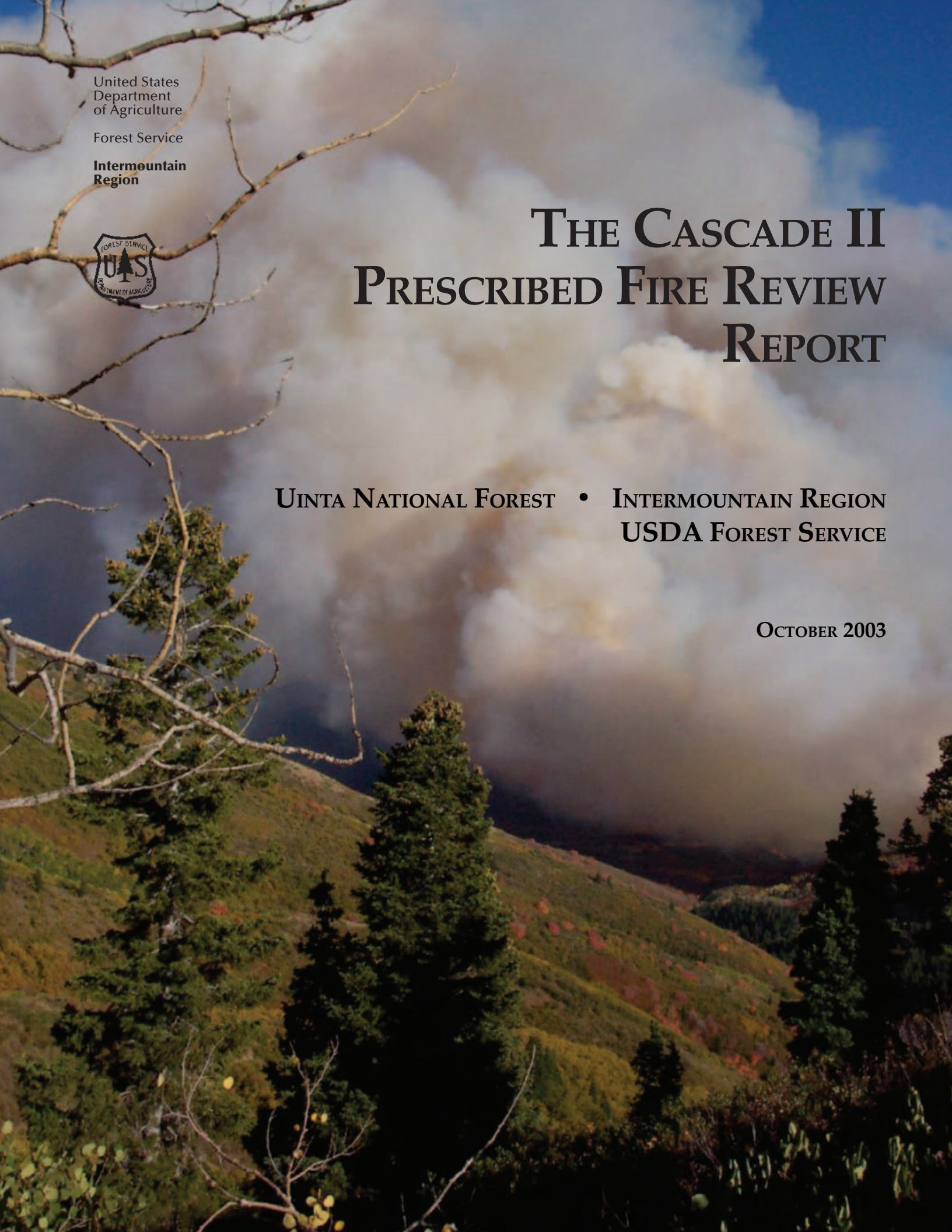

United States
Department
of Agriculture

Forest Service

**Intermountain
Region**

The Cascade II Prescribed Fire Review Report

Uinta National Forest • Intermountain Region
USDA Forest Service

October 2003

"I understand and appreciate the concerns raised by residents in Utah and Wasatch counties about the Cascade II Prescribed Fire.

Whenever something goes wrong, it is critical that we learn why and make the necessary changes to insure that our program is implemented in the most professional way possible."

Jack Troyer, Regional Forester
Intermountain Region
USDA Forest Service

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*C**over Photo** – Shows the escaped Cascade II Prescribed Fire 20 minutes after it was declared a wildfire. At this time, the holding crew forces reported to their safety zone at "The Overlook."*

Cascade II Prescribed Fire Review Team
Salt Lake City, Utah

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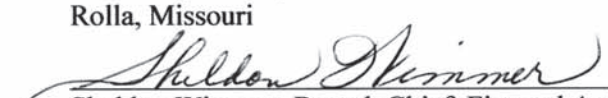
Forest Supervisor, Mark Twain National Forest
Rolla, Missouri



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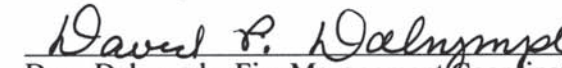

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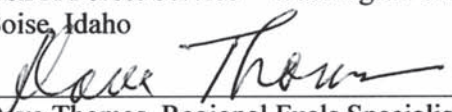

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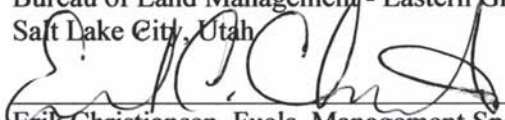

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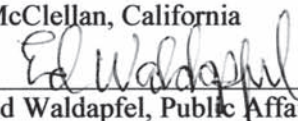
Portland, Oregon

Christie Neill, Assistant Regional Fuels Specialist - Operations — Team Member
USDA Forest Service – Pacific Southwest Region
McClellan, California



Ed Waldapfel, Public Affairs Officer — Team Member
Sawtooth National Forest
Twin Falls, Idaho

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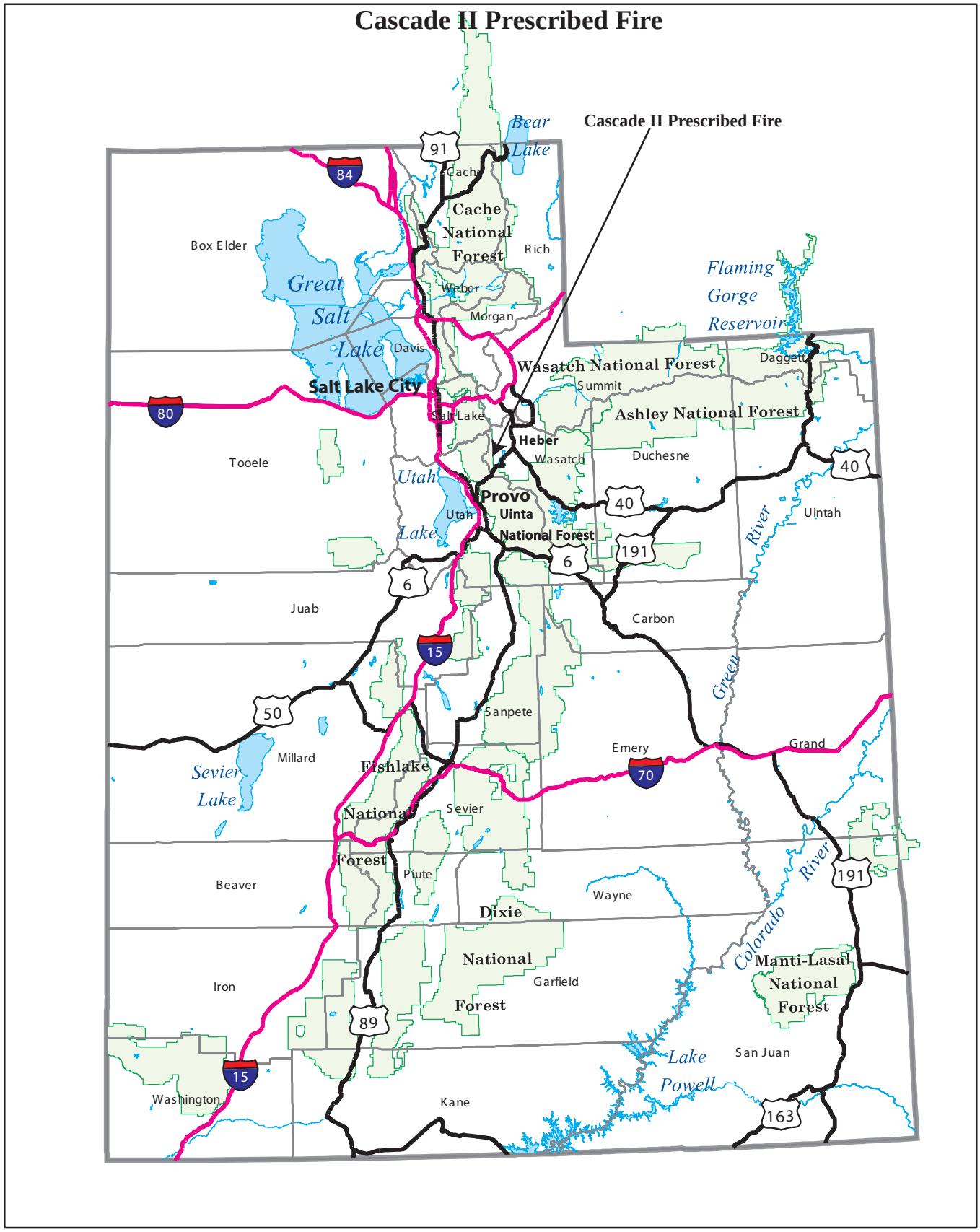
". . . For many Utahns, the (Cascade II) fire wasn't a positive event. People with respiratory ailments suffered as a thick blanket of smoke enveloped metropolitan areas in Salt Lake and Utah counties. School recesses and soccer games were canceled in some communities.

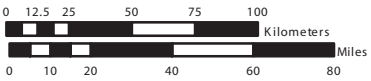
The Utah Department of Environmental Quality advised senior citizens, children and anyone with heart disease or breathing problems to stay indoors and avoid the smoke.

Again, prescribed burns are one of many tools the Forest Service uses to clear mountain brush. Under ideal conditions, the fires are contained to the specified area. But given persistent drought conditions and hotter-than-normal temperatures in recent days, many people have questioned why the Forest Service elected to conduct this prescribed burn at this time. . ."

October 1, 2003 Editorial
Salt Lake City Tribune

Cascade II Prescribed Fire





The Cascade II Prescribed Fire Review Report

Introduction

"We want to be successful in achieving an open, honest and factual review of what happened on this fire—not only for the sake of the agencies, but also for the public.

We want to identify lessons learned from this experience and make whatever changes are necessary to help us do a better job on future prescribed burns."

Ronnie Raum
Review Team Leader

A. Origin and Purpose of This Review

Intermountain Region Requests an Outside, Interagency Review

On October 3, 2003, Jack Troyer, Regional Forester for the Intermountain Region (Utah, Nevada, Southern Idaho, and portions of California and Wyoming), requested an interagency review of the September 23, 2003 Cascade II Prescribed Fire on the Uinta National Forest.

Troyer authorized this special panel to examine the planning and implementation of this approximately 1,000-acre planned prescribed fire. He also asked for a thorough analysis of the factors that led to the fire's eventual escape from its planned boundaries. The Cascade II Prescribed Fire became a 7,828-acre wildfire that was contained seven days later.

Wildland fire agencies frequently review prescribed fires that burn beyond their planned boundaries.

Review Team Includes Representatives from BLM, State of Utah, and Forest Service

This national 10-member team of experts in fire behavior, fuel management, fire weather, and prescribed fire operations, launched its formal review on October 19, 2003. The team—whose members came from Missouri, California, Oregon, Idaho, and Utah—included representatives from the Bureau of Land Management, State of Utah, the USDA Forest Service.

Regional Forester Jack Troyer instructed the Review Team to specifically address six review objectives:

Review Objectives

Prescribed Fire Qualifications

- Did the personnel planning and implementing the prescribed fire meet the qualification standards as established in the Forest Service Handbook (FSH 5109.17)?

Prescribed Fire Policy

- Was National and Regional prescribed fire policy followed—as outlined in the Forest Service Manual and the Regional Forest Service Supplement 5140?

Air Quality Issues

- Did the prescribed fire Burn Plan and the actual implementation of the prescribed fire adequately address air quality issues?

Prescribed Fire Burn Plan

- Was the prescribed Burn Plan properly prepared and implemented?
- Was the prescribed Burn Plan's holding, ignition and contingency plan elements based on predicted fire weather and fire behavior?

Key Fire Behavior Input Variables

- What were the key fire behavior input variables on the day of ignition?
- Did the environmental variables (weather and fuels) on the day of ignition correspond to what was prescribed in the Burn Plan?

Drought Effects

- Were the effects of being in a five-year drought adequately addressed in both planning and implementation of this prescribed fire?

Review Team Process

The Review Team spent the week of Oct. 19-24 in Salt Lake, Wasatch and Utah counties visiting and studying the prescribed fire location, interviewing key personnel, researching, examining decision-making processes, and reviewing all materials relevant to the Cascade II Prescribed Fire.

The review process included interviews with key personnel associated with the Cascade II Prescribed Fire, contacts with state and local government officials, and meetings with local residents at two public "listening sessions" in Provo and Heber City.

Purpose of the public listening sessions:

- To honor the request from the public to have access to the team reviewing this fire.
- To allow citizens the opportunity to provide the Review Team with factual information about the fire and to ensure that the review objectives address their major concerns.

B. Public Listening Sessions

Provo Session

Fifteen people attended the October 21 public listening session held in Provo. Format for the meeting included brief opening remarks concerning the meeting purpose, agenda for the evening, and the goal and objectives for the Cascade II Prescribed Fire Review.

Members of the Review Team staffed five listening stations that centered on the primary objectives for the review: Qualifications of Personnel, National and Regional Policy, Air Quality, Burn Plan and Fire Behavior. Meeting attendees participated by sharing their comments with Review Team members.

Highlights of primary topics of concern voiced by the meeting attendees included:

- Effects of the wildfire smoke on health.
- Accountability for potential mistakes made on the Cascade II Prescribed Fire.
- Adequacy of contingency forces on hand during the day of ignition.

The Review Team examined the Cascade II Prescribed Fire location with the key people involved in the burn.

- Procedures for becoming Burn Boss qualified.
- If a prescribed fire's Burn Plan is 100% executed, can escapes still occur?
- Use of mechanical treatments for fuel reduction projects.

Heber City Session

Fifty people attended the October 22 Heber City public listening session. General topic highlights shared with the Review Team:

- Timing of the Cascade II Prescribed Fire in light of recently lifted fire restrictions and continued drought.
- Weather conditions and local winds at the time of this prescribed fire.
- Availability of adequate local weather data.
- Need to restore livestock grazing to reduce fuels.
- Allegation that the Forest Service did not aggressively attack the escaped fire to allow land proposed under the Cascade III treatment area to burn.
- A possible lack of contingency firefighting resources.
- Failure to use the local firefighting agency and private equipment.
- Attitude and defensiveness of Forest Service spokespeople during media interviews in the aftermath of the Cascade II Prescribed Fire escape.
- A concern that "common sense" needs to be part of the Forest Service's Burn Plan decision process.
- Lack of local input into the planning for this prescribed fire.
- An allegation that this prescribed fire was conducted in spite of ostensibly high-risk conditions simply to meet deadlines or risk losing funding.
- Need to review and update the initial Cascade II Prescribed Fire planning that was undertaken in 1999.
- The prescribed fire Burn Plan "Go/No Go" checklist needs to be changed.
- Fire rehabilitation needs to be promptly implemented.
- Concerns voiced about deer herds this winter.

Much of the input received at both public sessions is beyond the scope of the Review Team's responsibility. This information has therefore been documented and made available to local Forest Service officials.

C. Purpose and Intent of The Cascade II Prescribed Fire

Planning for the Cascade II Prescribed Fire began in January 1999. This planned approximate 1,000-acre prescribed fire was part of a total 3,800-acre project that includes three individual planned prescribed fires. The first, Cascade Springs I, was successfully implemented during the spring of 2000.

Cascade II Prescribed Fire Burn Plan Specific Goals and Objectives

Resource Management Goals

- Hazardous fuel reduction.
- Obtain vegetation diversity to improve ecosystem health.
- Provide a healthier watershed for wildlife and forage for livestock.

Specific Resource Management Objectives

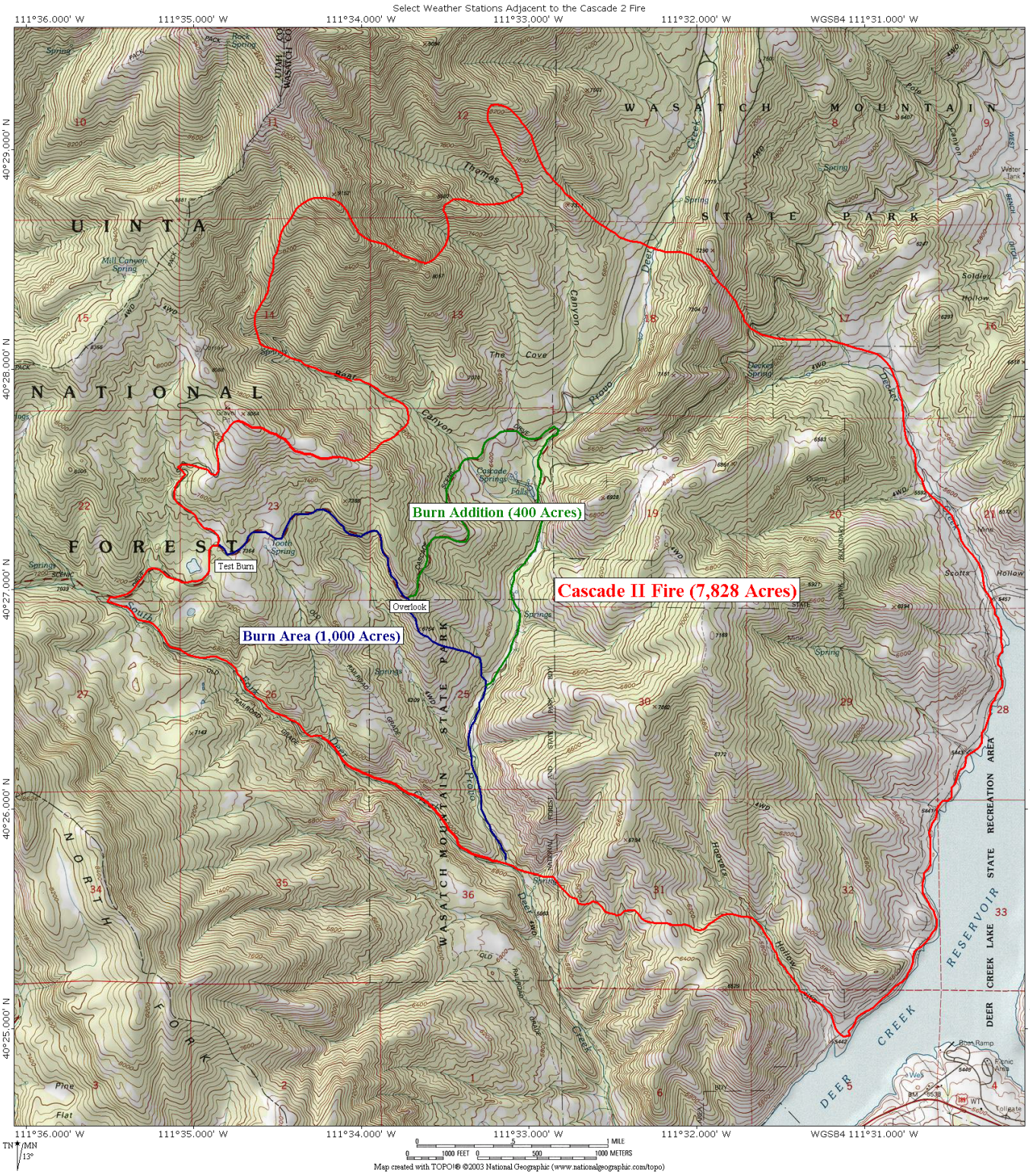
- Burn areas of heavy oak brush to improve wildlife habitat and to reduce hazardous fuel.
- Burn understory of aspen stands to promote sprouting of new aspen pockets.

Prescribed Fire Objectives

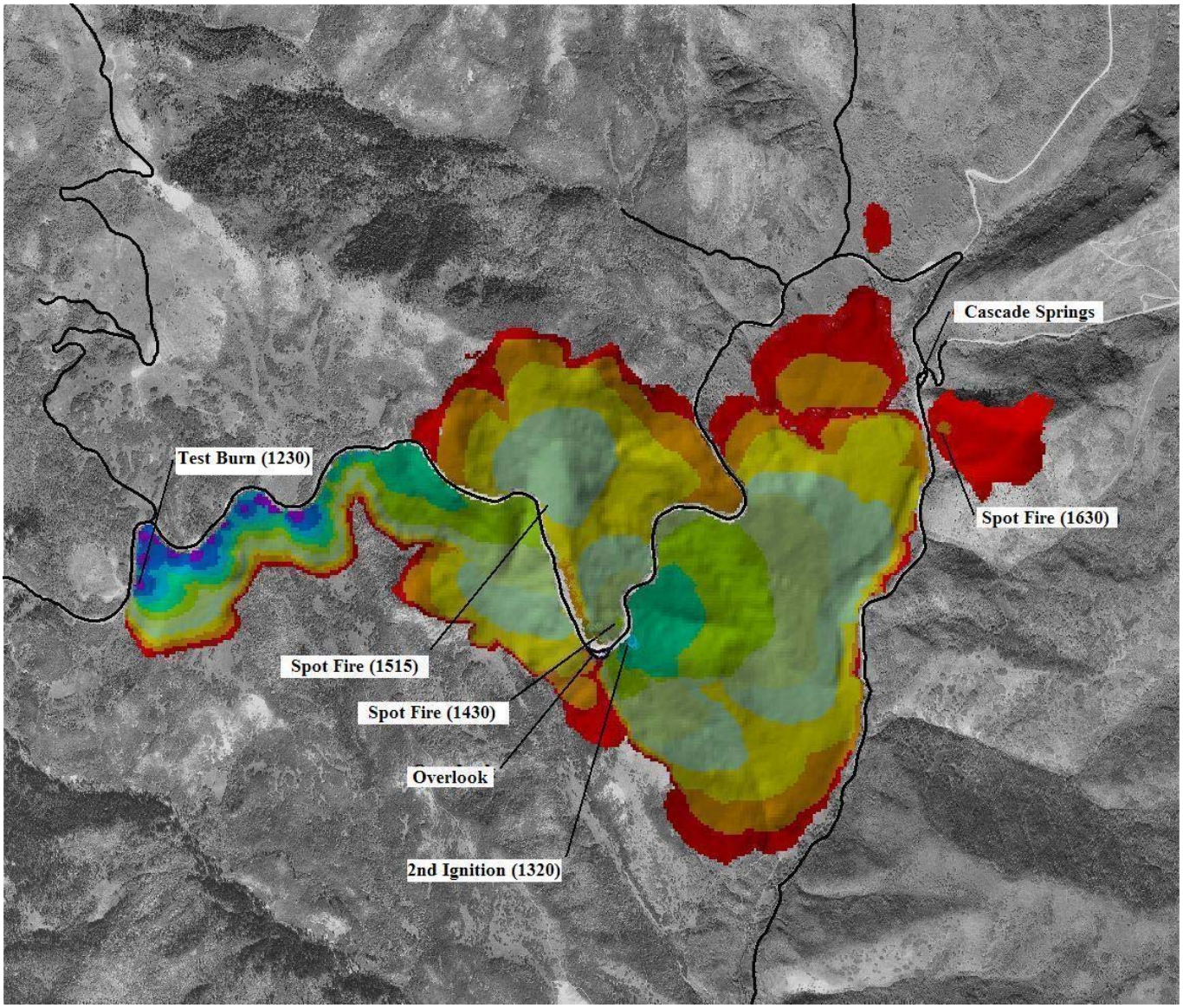
- Burn 30-90% of the treatment area in a mosaic pattern to reduce hazardous fuel—predominantly within the brush species.
- Conduct fuel inventory on the plots (that measure potential fire intensity) placed in 2001 to determine if objectives have been met.

Resource Concerns

- Limit the mortality of cottonwood trees at the south end of the prescribed burn. Fire will be allowed to creep or lightly burn to within 100 feet of perennial streams.



Topographic map of the Cascade II Prescribed Fire burn unit (blue), the burn addition (green), and the final wildfire perimeter (red).



Cascade II Fire Progression

Computer-generated (“FARSITE” Fire Area Simulator) estimate of the Cascade II Prescribed Fire.

Cascade II Prescribed Fire Chronology

Cascade II Prescribed Fire Chronology

January 1999

Public recommendations and comments elicited from the following three outreach efforts are included in the analysis and development of the proposed Cascade II Prescribed Fire project:

- Cascade II Prescribed Fire "scoping" letter—outlining the proposed project's purpose and implementation details—is mailed to more than 45 groups and interested citizens.
- A newspaper article on the proposed project is published in the *Provo Daily Herald* and *Wasatch Wave* newspapers.
- The proposed project is listed in the Uinta National Forest's winter edition of its NEPA (National Environmental Policy Act) quarterly schedule of planned projects (and repeated in the spring edition).

June 1999

- A field tour of the proposed project area is provided to interested adjoining private land owners, public representatives, media, and interested individuals.

August 1999

- A field tour of the proposed project area is provided to representatives of the Wasatch State Park and Utah Division of Wildlife Resources.

November 16, 1999

- The Decision Notice for the Cascade Springs and North Fork Prescribed Burns (including the Cascade II Prescribed Fire) is signed by the District Ranger of the Pleasant Grove Ranger District, Uinta National Forest.

August 23, 2000

- The Cascade II Prescribed Burn Plan is completed.

April 2, 2002

- The Cascade II Prescribed Burn Plan is approved by the Forest Supervisor of the Unita National Forest.

April 10, 2003

- Cascade II Burn Plan Amendment is signed by the Uinta National Forest Forest Supervisor.

September 19, 2003

- The Uinta National Forest distributes press releases informing the public of the proposed Cascade II Prescribed Fire scheduled for the week of Sept. 22-27.

September 22, 2003

- Weather observations (including winds, relative humidity, temperature, average 10-hour fuel moisture) are recorded at the Cascade II Prescribed Fire site. A Spot Weather Forecast is made for noon the following day.

September 23, 2003

- The Cascade II Prescribed Fire Burn Boss and District Ranger of the Pleasant Grove Ranger District sign the proposed project's "Go/No Go" Check List. (All 13 of the check list's risk assessment questions are answered in the affirmative, allowing the prescribed fire to be ignited—as outlined in the Burn Plan.)

9:45 a.m.

- On-site weather observations are measured and recorded at the Cascade II Prescribed Fire site. A Spot Weather Forecast is requested.

10:23 a.m.

- Spot Weather Forecast is received.

12:15 p.m.

- On-site weather observations are measured and recorded at the Cascade II Prescribed Fire site.

12:30 p.m.

- Test burn ignited—low rate of spread was observed.

12:40 p.m.

- The Cascade II Prescribed Burn is ignited on the project's west side. (Weather observations are continuously communicated from the project's Weather Observers.)

2 p.m.

- Prescribed fire is burning well with southwest winds recorded at 6 mph—gusting to 12 mph.

2:30 p.m.

- A small spot fire occurs over the containment line on the east end of the ignition operations.

3 p.m.

- A second spot fire occurs over the project's containment line.
- Weather observations indicate temperature is 74 degrees, relative humidity is 16%, and winds are from the west at 7 mph and gusting to 14 mph.

3:30 p.m.

- Second spot fire is burning toward the first spot fire.

3:35 p.m.

- Rapid fire spread is observed.

5 p.m.

- The fire—now declared an escaped wildfire—estimated at 500 acres, is burning toward Cascade Springs.

5:20 p.m.

- The prescribed fire "holding resources" personnel report to the project's designated safety zones.

Section One
Prescribed Fire Qualifications

1. Issue

Did the personnel who planned and implemented the Cascade II Prescribed Fire meet the qualification standards as established in the Forest Service Handbook (FSH 5109.17)?

Forest Service Manual (FSM) Qualification Standards FSM 5142.2 – *Each prescribed fire Burn Plan (RXBP) should be reviewed and recommended for line officer approval by a qualified and experienced fire manager.*

FSM 5145.21 – *On high complexity prescribed fire projects, the RXBP is developed by the prescribed fire planning specialist (RXPL).*

1. Finding

As required by the Forest Service Manual (FSM 5142.2), the Uinta National Forest had the Cascade II Prescribed Fire Burn Plan reviewed and recommended for line officer approval by a qualified and experienced fire manager.

2. Finding

The individual who prepared the Cascade II Prescribed Fire Burn Plan attended all the required training but was not certified by the Uinta Forest Red Card Committee as a Prescribed Fire Planning Specialist.

Qualifications as a Prescribed Fire Planning Specialist position are required for preparation of complex Burn Plans such as the Cascade II project.

3. Finding

The Uinta Forest Red Card Committee certified the Cascade II Prescribed Fire Burn Boss as qualified by using the position task book system and recognized the Burn Boss as a qualified Prescribed Fire Burn Boss Level 1 in 2002.

The Cascade II Prescribed Fire Burn Boss's qualifications were based on:

A. The White River National Forest-accepted equivalent training for RX 300 Prescribed Fire for Burn Bosses NWCG (National Wildfire Coordinating Group) 40-hour course (required in FSH 5109.17 when individual is qualified for Prescribed Fire Burn Boss Level 2) with an eight-hour course on prescribed fire during April 1987 in Montrose, Colorado, and a prescribed broadcast burning workshop in September 1978.

B. The White River National Forest (a previous duty station of the Burn Boss) accepted equivalent training for RX 450/410 Smoke Management Techniques NWCG 40 hour course (required in FSH 5109.17 for Prescribed Fire Burn Boss Level 1) with Smoke Management for Practitioners four-day course held at the Boise Interagency Fire Center March 7-10, 1989.

C. The Uinta National Forest Red Card Committee and the White River National Forest both accepted a Managing Fire Effects workshop held in May 1995 as equivalent for RX 340 Introduction to Fire Effects and equivalent for M-580 Fire In Ecosystems Management. Rx 340 was required per the 5109.17 in 1992 for Burn Boss 2, and M-580 was required per 5109.17 in 2002 for Burn Boss Level 1.

D. The Red Card Committee-accepted request from individual (Cascade II Burn Boss) asking to be qualified as Prescribed Fire Burn Boss Level 1 when the task book evaluator recommended individual still perform as a trainee before being fully qualified as Prescribed Fire Burn Boss Level 1 for helitorch ignition.

E. Accepted request from employee to use work history in lieu of M-581 Fire Program Management.

F. The Forest Service Handbook (FSH 5109.17) does not allow any Level 2 equivalent training for any prescribed fire positions except RX340/310 Fire Effects. Completion of Technical Fire Management is accepted as equivalent for Fire Effects.

Requirements of Forest Service Handbook 5109.17 were not followed to certify this individual as Burn Boss Level 2 in April 1992. Therefore, this individual does not meet the technical qualifications for Burn Boss Level 1. The Cascade II Prescribed Fire required a complexity Level 1 Burn Boss certification.

Although well experienced in prescribed fire and fire suppression operations, the Cascade II Burn Boss had not completed some of the requirements for his position as Level 1 Burn Boss.

It should be further noted that the Burn Boss had formally submitted his relevant training and experiences in a request to be qualified as Burn Boss Level 1. However, the agency's acceptance of equivalent training is a deviation from agency policy.

4. Finding

The Cascade II Prescribed Fire Ignition Specialist was qualified per the Uinta National Forest's training records and Forest Service Handbook (FSH 5109.17) required training.

The Red Card qualifications system recognizes the Cascade II Prescribed Fire Ignition Specialist as qualified at both Levels 1 and 2.

1:30 p.m. lighting at the Overlook.

Section Two
Prescribed Fire Policy

1. Issue

Was National and Regional prescribed fire policy followed—as outlined in the Forest Service Manual and the Regional Forest Service Supplement 5140?

1. Finding

Planning and implementation of the Cascade II Prescribed Fire were reviewed to determine compliance with prescribed fire policy of Forest Service Manual 5140 and Intermountain Region R4 Supplement 5140 (5100-2003-1).

Several inconsistencies were discovered:

- Some of the planning and implementation personnel did not meet qualifications standards.
- An area outside of the prescribed burn unit was intentionally ignited without additional analysis or the necessary line officer approval.
- The burn prescription did not meet the level of detail needed for a high complexity burn.
- The Cascade II Prescribed Fire contingency plan did not meet the level of detail required.
- The Uinta National Forest was operating under a draft fire management plan.

Explanation and References for Policy Inconsistencies

2. Finding

Qualifications
As discussed in the previous section, the person who prepared the Burn Plan attended all the required training but was not certified by the Uinta Forest Red Card Committee as a Prescribed Fire Planning Specialist. In addition, the Burn Boss had been certified incorrectly by the agency to serve in that position.

This is inconsistent with FSM 5145.21: *"The Prescribed Fire Specialist develops the Prescribed Fire Burn Plan for each high complexity prescribed fire;"* and FSM 5140.31.7: *"Each prescribed burn must be conducted by a qualified burn boss."*

3. Finding

Burning Outside of Approved Burn Unit
FSM 5140.31.2 states: *"A Prescribed Fire Burn Plan must be prepared and approved prior to prescribed fire ignition."* The Cascade II Burn Plan did not include the area above Cascade Springs and east of the Unit 2 boundary. In addition, this approximate 400-acre parcel was not included in any other Burn Plan.

FSM 5140.31.8 states: *"Approval of a Prescribed Fire Burn Plan or a Wildland Fire Implementation Plan (WFIP) constitutes firm limits on the prescription to be applied and objectives to be achieved."* Clearly, burning an area that has not been delineated within the prescribed fire Burn Plan exceeds these "firm limits".

The approving line officer had not been made aware of nor approved the decision to ignite the area outside of Unit 2.

4. Finding

Insufficient Detail in Burn Plan Prescription
FSM 5142.2 states that each Burn Plan *"must address elements described in the Wildland and Prescribed Fire Management Policy Implementation Procedures Reference Guide"* and that *"the detail needed must be commensurate with project complexity."*

The Burn Plan includes the NWCG Complexity Elements Worksheet that clearly identifies the Cascade II Prescribed Fire as a complex burn.

The Review Team has concluded that the Burn Plan's prescription was so general that it included conditions that would not be controllable. For example, the plan would allow ignition with a combination 10% relative humidity and 10 mph mid-flame wind. In addition, the prescription would not achieve the Burn Plan's objective of "age and structural diversity in vegetation".

Throughout the Burn Plan there are numerous examples of insufficient detail for such a complex burn. These omissions include prescription details such as the lighting sequence, and the combinations of wind speed and relative humidity necessary to achieve Burn Plan objectives.

5. Finding

Contingency Plan Inadequate
R4 Supplement 5140 (5100-2003-1) requires a written contingency plan which *"describes resources and actions necessary to mitigate risks and potential consequences identified in the NWCG Prescribed Fire Complexity Rating System Guide…that are possible but not likely to occur."*

Although the Burn Plan included a written contingency plan, it did not address all of the elements in the Complexity Rating Guide, nor did it specifically identify all actions necessary to mitigate risks and potential consequences.

Further, the contingency plan did not base number and kinds of resources on an analysis of expected fire behavior (rates of spread and intensities) and line construction rates of suppression resources.

6. Finding

Fire Management Plan Not Approved
Forest Service Handbook (FSH) 5109.19, Fire Management Analysis and Planning Handbook, Chapter 50 – Fire Management Planning section 50.3 – Policy subsection 1 states: *"Each National Forest with burnable vegetation must have an approved fire management plan (Sec. 52.2) that has been prepared, reviewed, and approved annually in conformance with requirements set out in this Handbook…"*

The Uinta National Forest is operating under a draft fire management plan developed to reflect the Forest's recently revised Land and Resource Management Plan. However, the final approval of the fire management plan is pending.

Although policy does not specifically state that a signed fire management plan is required to implement a prescribed fire, a lack of a signed fire management plan was noted by the Review Team as a fire management program deficiency.

This deficiency, however, in no way contributed to the escape of the Cascade II Prescribed Fire.

Section Three
Air Quality Issues

Overall Issue

Did the Cascade II Prescribed Fire Burn Plan and the actual implementation of the prescribed fire adequately address air quality issues?

1. Issue

The Cascade II Prescribed Fire Burn Plan did not identify how compliance would occur with the State of Utah Department of Air Quality (DAQ) regulations.

Finding

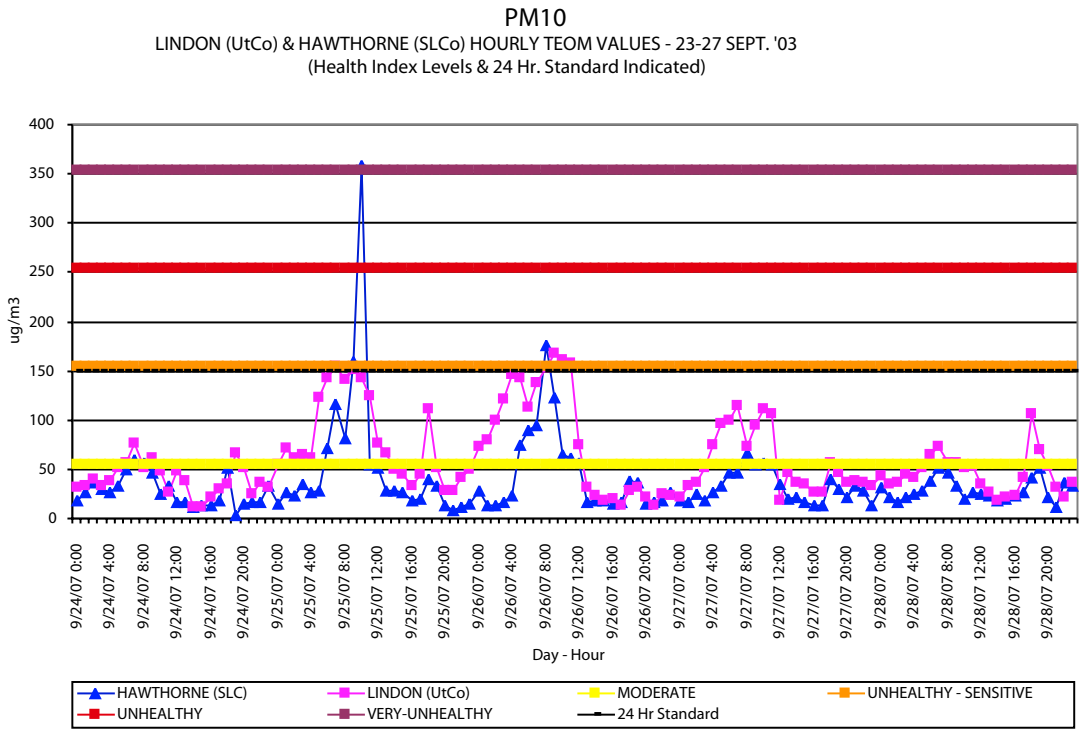
Although *how* DAQ regulation compliance would be achieved was not identified, the DAQ process was nonetheless completed. DAQ approvals were received to proceed.

2. Issue

The Burn Plan did not identify a smoke contingency plan.

Finding

Smoke management plans are required by FSM 5140 policy to identify actions required to mitigate smoke impacts if they begin to occur during project implementation. Contingency actions such as notifications to impacted areas to alert people about smoke, patrols in areas to monitor smoke impact, stopping ignition and fire spread to reduce smoke production, are all items that could have been addressed in the smoke management portion of the Burn Plan.



Data from air monitoring stations near Provo (Lindon) and Salt Lake City (Hawthorne) indicating PM-10 levels in 4-hour increments. Note that at 0800 on September 25, the PM-10 level at Hawthorne spiked to a "very unhealthy" level for four hours.

3. Issue

The Burn Plan did not identify unacceptable smoke impacts.

Finding

FSM 5140 requires the smoke management portion of the Burn Plan to address unacceptable smoke impacts. Examples include: winds transport smoke towards identified smoke sensitive areas, smoke reduces visibility on main travel routes to less than 1/4 mile. These items where not sufficiently addressed in the Burn Plan.

4. Issue

Was Smoke Modeling completed for the Cascade II Prescribed Fire?

Finding

Smoke modeling was done only for the Cascade II project area and not the additional acres ignited above Cascade Springs—located outside the approved Burn Unit. Smoke modeling was not completed for any other transport wind direction or any other contingency.

5. Issue

Did public notification of potential smoke impacts occur?

Finding

The Cascade II Prescribed Fire's key public contacts (including phone calls and letters) and press releases prior to the implementation of the Cascade II Prescribed Fire identified potential visible smoke in the Heber Valley area.

Cascade II Prescribed Fire is ignited at 12:40 p.m. on September 23, 2003. Photo is facing southwest.

At 2:15 p.m., the prescribed fire makes a run toward the east. Photo is facing southwest.

At 5:00 p.m. the escaped prescribed fire is declared a wildfire. This photo, taken at 5:10 p.m. shows the wildfire—estimated at 500 acres—moving toward Cascade Springs. Photo is facing south.

Section Four
Prescribed Fire Burn Plan

1. Issue

Was the prescribed Burn Plan properly prepared and implemented?

Finding

Forest Service policy requires all prescribed Burn Plans to address elements identified in the *Wildland and Prescribed Fire Management Policy Implementation Procedures Reference Guide*.

While these elements were acknowledged in the Cascade II Prescribed Fire Burn Plan, they were addressed in a superficial and confusing manner.

The Decision Memo (the document allowing the vegetation management treatment for the prescribed burn) identified several implementation and mitigation measures that were not addressed in the Burn Plan.

Furthermore, the Review Team believes that the lack of specificity in the various Burn Plan elements contributed to confusion in executing this prescribed fire.

Conformance to the Required *Wildland and Prescribed Fire Management Policy Implementation Procedures Reference Guide:*

- ***Description of the Prescribed Fire Area, including map, using the MMA (Maximum Manageable Area) Concept.***
  Although a map of the Cascade II Prescribed Fire burn unit was included in the Burn Plan, it did not show the additional 400 acres located above Cascade Springs that was added to the burn unit (without line officer approval).
- ***Goals and Objectives.***
  These elements were well identified.
- ***Range of acceptable results expected.***
  The range of acceptable results were identified to meet management goals.
- ***Project Assessment (Complexity/Risk Assessment)***
  The NWCG Complexity Elements Worksheet was used, and clearly identified this as a complex burn.
- ***Prescribed Fire Implementation Actions:***

  1. ***Pre-burn considerations, On-Off Site.***
     A limited evaluation with few specifics was made of the project area. Decision Memo mitigation requirements were not fully addressed in the Burn Plan.

  2. ***Briefing.***
     A Briefing Guide was found in the Burn Plan. Major items such as an Organization Chart and LCES (safety standards), however, were not included.

  3. ***Test Fire.***
     The Burn Plan requires a test fire. Test fires are to be ignited in a representative fuel model within the prescribed fire area to test: if smoke dispersal and direction are acceptable; if fuel consumption is adequate; and if fire behavior is within desired parameters.

     The Review Team was informed by personnel on the burn that a small spot fire developed across the control line shortly after the test fire was ignited and firing operations began.

     The Cascade II Prescribed Fire's test fire was conducted in fuels that represent solely a minor component of the project's overall fuel type. A test fire in this fuel type therefore underestimated the potential fire behavior in the area's predominate oak brush fuel type.

  4. ***Prescribed Fire Prescription.***
     The Burn Plan included a broad prescription that covered multiple burning seasons and a wide range of fire behavior variables. This array of variables was both confusing and required considerable interpretation by the Burn Boss.

A matrix developed for the California chaparral fuel model was used which provided inadequate and confusing prescription parameters for the oak, maple and aspen fuels found in the Cascade II Prescribed Fire area. The Burn Boss and Prescribed Fire Planner had not been trained in the use of this matrix and used it inappropriately.

5. ***Special Considerations.***
   Both public and fire personnel safety were adequately addressed.

6. ***Burn Organization.***
   The Cascade II burn organization lists the required management personnel and the positions they were to fill. The Burn Plan contained two different organizational charts. Therefore, the Review Team was unable to determine what resources were required.

7. ***Ignition Plan.***
   The Cascade II ignition plan is difficult to understand. It mixes different methods of ignition, times and places, and standards. No ignition organization was specified. Necessary resources, personnel qualifications, equipment, and supplies were listed in a confused and disorganized manner. The map provided in the Burn Plan was incomplete.

8. ***Holding Plan.***
   The Prescribed Burn Organization Chart identified those resources and personnel responsible for holding actions. It provides necessary general instructions for holding the prescribed fire within actual boundaries.

9. ***Cooperation.***
   A Notification Plan to provide advance notice of pending prescribed fire activity was included in the Burn Plan.

10. ***Contingency Plan.***
    Contingency resources were identified and on site. However, should an escape occur, there was no indication that any appropriate analysis was conducted to determine contingency resources commensurate with the expected fire behavior.

11. ***Funding.***
    The Burn Plan contained a cost data sheet.

12. ***Smoke Management.***
    (See findings in Section Three.)

13. ***Monitoring.***
    A monitoring and post-burn evaluation worksheet is included in the project's Burn Plan. The questions asked within this evaluation should allow management to determine if the Cascade II Prescribed Fire met its objectives.

2. Issue

Were the prescribed Burn Plan's holding, ignition and contingency plan elements based on predicted fire weather and fire behavior?

Finding

Planning for holding, ignition, and contingency forces appears to be based on experience rather than quantitative analysis. Computer-generated fire behavior projections ("BEHAVE 4.1") were completed for a range of weather variables. However, there is no documentation in the Burn Plan that indicates the Burn Planner utilized the results of these projections to estimate forces necessary to ignite, hold and—if necessary—suppress potential escapes.

No attempt was made to determine the size of an escape—should one occur—nor was the amount of fire line construction modeled to contain an escape.

Section Five
Key Fire Behavior Input Variables

1. Issue

What were the key fire behavior input variables on the day of ignition?

Finding

Weather Preceding the Prescribed Fire Ignition

Two weeks prior to igniting the Cascade II Prescribed Fire, the burn area vicinity received 0.6 to 1.2 inches of precipitation.

The weather pattern for the days just prior to the incident was dominated by an area of high pressure over the western United States. This persistent pattern effectively prevented much day-to-day change in Utah. Relatively stable conditions precluded the chance for thunderstorm development.

The day of the prescribed fire, a weak trough passed through the high pressure ridge, slightly increasing the wind over the northern half of the state. Temperatures were slowly on the rise. Dry air also contributed to very low relative humidity during the day of ignition, with poor recovery at night.

2. Issue

Did the environmental variables (weather and fuels) on the day of ignition correspond to what was prescribed in the Burn Plan?

1. **Finding**
The weather and environmental variables did correspond to what was prescribed in the Burn Plan.

2. **Finding**
Provisions were not made to supplement or enhance the existing weather network.

Only one of the 29 weather-observing stations within 10 miles of the project area meets the National Fire Danger Ratings System (NFDRS) requirements for fire weather data. This observation (PGRU1 – Pleasant Grove RAWS) is located on the west side of the Wasatch Front, nine miles west of and 2000 feet lower than the project area, making it unrepresentative of conditions in the Cascade II fire area. Twenty of the remaining 28 observations are dedicated to snowfall and snow depth recording and, thus, are not located to provide adequate information for use in fire operations.

2. **Finding**
Observations provided in the Spot Weather Forecast requests were inadequate for making useful or valid assessments of weather conditions in the Cascade II Prescribed Fire area.

Each Spot Weather Forecast request contained only one manual observation taken at the project site. While the observations were taken at different times of day, three observations in three days are insufficient for determining diurnal weather trends that might impact burning operations.

Portable RAWS (Remote Automated Weather Station) or FireRAWS stations to provide 24-hour weather monitoring for a period of days (or even weeks) before the operation were not deployed around the project area.

3. Issue

Spot Weather Forecasts were requested on three consecutive days prior to ignition, including the day of ignition.

The National Weather Service (NWS) in Salt Lake City, Utah, received and filled three Spot Weather Forecast requests for the project on: Sunday, Sept. 21 at 1350 MDT; Monday, Sept. 22 at 1659 MDT; and Tuesday, Sept. 23 at 1023 MDT.

1. **Finding**
Requested weather parameters were too general to properly address conditions during the burning period.

Spot Weather Forecasts are designed to account for local, terrain-driven effects on weather patterns. It is incumbent on the user to request the information that is most important for the project. For example: temperature/humidity at ignition,

wind speed / direction, and trends during the burning period, etc.

The parameters requested in the three Spot Weather Forecasts were: Lightning Activity Level (LAL), Haines Index, Clearing Index, Sky / Weather, Temperature, Humidity, and Eye-level Wind. These are basic parameters that are found in the daily, general fire weather forecasts. Some of these, such as Lightning Activity Level, provide little useful information for a project burn.

There was no request for specific forecast information that pertained to the operational period of the burn.

2. Finding

The Spot Weather Forecasts were requested through the Northern Utah Interagency Fire Center (NUIFC).

Weather observations were phoned into the local dispatch center where a dispatcher made the online request for the Spot Weather Forecasts. This is standard operating procedure.

While this procedure is not in violation of any policy, it increases the potential for miscommunication or misinterpretation by eliminating direct communication between a weather forecaster and a member of the project team.

4. Issues

- ***Wind speed and direction at time of ignition.***
- ***Moisture content of fuels within the prescribed burn and outside the burn's control lines.***
- ***Fire behavior projections based on wind speed, direction, and fuel moisture content.***

1. Finding

Sustained wind speeds were within prescription parameters. Measured wind gusts, however, were not. No wind direction was specified. Both temperature and relative humidity were within prescription parameters. Live fuel moisture was within prescription parameters.

No 10-hour time-lag dead fuel moisture values were obtained. Fire behavior projections based on appropriate input values were done for head fires. No projections were made for backing fires.

No attempt was made to determine the size of an escape—should one occur—nor was modeling done for the amount of fire line construction necessary to contain an escape.

Wind

Eye-level winds at the time of ignition were as forecasted in the Spot Weather Forecast. They were also within the range of values that were considered to be the prescription—with the exception of the wind gusts measured at the weather observation site.

The winds that were measured at 1215 hours at the test burn site (where ignition commenced) were reported to be southwest (essentially up-slope) at 3-5 mph. At 1300 hours above the burn at the weather observer's location, they were recorded to be west at 6 mph, with gusts to 12 mph.

The gust to 12 mph is not considered to be out of prescription because gusts were not specifically mentioned in the Burn Plan.

The Spot Weather Forecast indicated that winds were to be up-slope / up-valley 3-6 mph with afternoon gusts to 8 mph. The wind values considered to be those prescribed were 0-10 mph, but the wind direction for implementation purposes was not specified in the Burn Plan. (A southwest wind was desired for smoke dispersal purposes. Any wind direction, however, was deemed acceptable for that purpose.)

As the day continued, the weather observer above the burn continued to measure winds from 5-9 mph—predominately from the west—with gusts measured up to 15 mph.

Thus, the steady winds remained within the values considered to be those of the prescription, but the gusts were not.

Temperature

Temperatures on the day of the burn were measured to be 70-75 degrees until 1700 hours, when the weather data for the prescribed burn was no longer taken. Maximum temperatures were forecasted to be 75-79 degrees, and the acceptable range of values in the prescription was 45-85 degrees.

Thus, temperatures during the day of ignition were within those that were prescribed in the Burn Plan.

Relative Humidity

The relative humidity experienced during the day of ignition was 32% when ignition began, but was then measured by the weather observer to be from 16-19% until 1700 hours. The forecasted minimum humidity was 19-24%. The acceptable range of relative humidity values was 0-35%.

Thus, the relative humidity was within the range of values prescribed within the Burn Plan.

Fuel Moisture

It is not known for certain if fuel moistures during the day of ignition were within the 55-90% range described in the Burn Plan. Live fuel moisture in the Gambel oak was measured to be 90.28% the day before the prescribed fire. Thus, live fuels could be considered to be within the range of values prescribed in the Burn Plan.

Dead Fuel Moisture

Dead fuel moisture of the 1-hour time lag fuel size was measured to be 5.02% on September 22, the day prior to ignition. No range of acceptable values was given for this size class fuel. An acceptable range of values for the 10-hour time lag fuel size was given in the prescription, and moistures of 4-15% were deemed to be acceptable. No 10-hour fuel moistures were obtained on the burn day, or the days immediately preceding the burn. They were estimated to be 7-9% on the day of the burn, but were not substantiated by any data.

Thus, no 10-hour time lag dead fuel moisture values were obtained. It is therefore not apparent if dead fuel moistures were within the values prescribed in the Burn Plan.

Fire Behavior Projections

Several different fire behavior projections were completed using the "BEHAVE 4.1" model. A wide variety of fuel models, slopes, fuel moistures, and wind speeds were utilized. Only head fires were modeled. Backing fires were not modeled. The "SIZE" and "CONTAIN" computer modules were not run.

It is unclear what purpose the BEHAVE runs served. The probability of ignition and the maximum spotting distances were not modeled.

Thus, fire behavior projections based on appropriate input values were done only for head fires. No projections were made for backing fires. No attempt was made to determine the size of an escape—should one occur—nor was the amount of fire line construction needed to contain an escape modeled.

Section Six
Drought Effects

1. Issue

Were the effects of being in a five-year drought adequately addressed in both planning and implementation of the Cascade II Prescribed Fire?

Findings

Long-term drought was not considered to be a factor in the escape of the prescribed burn.

Long-term drought typically affects the larger dead fuel components (the 100- and 1000-hour time lag fuel classes—dead fuels greater than one inch in diameter), and the live fuels. Smaller dead fuel size classes (the 1- and 10-hour time lag fuels—dead fuels less than one inch in diameter) respond primarily to diurnal (daily heating and cooling) changes in conditions.

Dead fuels in the prescribed burn area were predominately leaf litter, grass, twigs, and the small Gambel oak stems. These dead fuels occur within the 1- and 10-hour time lag categories. Consequently, they are not greatly affected by prolonged drought.

The live fuel moisture in the Gambel oak was considered to be average for this time of year. Because the foliage on the oak was reportedly frost-killed, it was also within the dead fuel category.

Before the Cascade II Prescribed Fire.

After the Cascade II Prescribed Fire.

Conclusion

The Review Team discovered:

- An inadequate Burn Plan.
- Inadequate pre-burn weather monitoring and analysis.
- Deviations from Forest Service policy.
- That individuals who planned and directed the Cascade II Prescribed Fire were incorrectly qualified by the agency.

Although many of these factors contributed to the Cascade II Prescribed Fire escape, the Review Team concluded that the primary cause of this escape was the decision to ignite the additional 400 acres (outside the originally planned Cascade II Prescribed Fire burn unit).

This area was burned without an analysis of holding and contingency force needs. The additional acreage, greater fire perimeter, and its proximity to a steep uphill slope required additional resources. Pre-burn planning for those resources had not occurred.

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