Mill Flat Fire Review

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Executive Summary

On August 29, 2009, the Mill Flat Fire which had been managed since July 25, 2009 rapidly burned out of the Pine Valley Wilderness on the Dixie National Forest in southern Utah moving down hill towards the town of New Harmony. By the time the smoke cleared the following morning, all the residents of the town had been evacuated, six homes were destroyed or severely damaged and several other buildings and corrals were significantly burned.

Due to the serious nature of the incident, the Intermountain Regional Forester assigned a team **(**see Appendix B) composed of Utah State and USDA Forest Service specialists to conduct a comprehensive review. The review team specialists included an Agency Administrator/team leader, a policy analyst representing the Forest Service Washington Office, a Utah State representative as the fire operations specialist, a fire behavior analyst, and a writer/editor.

The focus of the review team was to capture the lessons learned from the Mill Flat Fire and to share with the land management and fire management community at large. The team examined processes, actions and activities on the Mill Flat Fire to maximize learning opportunities. During the week of September 28, 2009, the team made a field visit to the fire, interviewed fire personnel, agency administrators, resource specialists, and community members. At the request of the Regional Forester, the team analyzed the decisions and actions related to Mill Flat from the fire's discovery on July 25th through the transition with the Type 1 Incident Management Team on August 31, 2009.

The intent of this review is to improve future performance by documenting and sharing individual, unit, and organizational lessons learned. Learning from success is important but learning from events with unintended outcomes is critical.

Wildland fire management decision making is always done under conditions of uncertainty. A review of fire management decision making cannot take, as its reference or starting point, the outcome of an incident. To do so is misleading and lends to a hindsight-bias by which the outcomes can appear inevitable from preceding conditions and decisions. To avoid a hindsight bias, this review focused on reconstructing the decision situation as it appeared to key decision makers at the time, given the policy framework in place and the information they had available to inform the decisions that shaped their actions. A foresight perspective accounts for the uncertainty that is inherent in wildland fire incident command as well as the risks to which firefighters are exposed.

Managers rely on the training and experience they have to help navigate through the interconnecting decisions that must be made in managing a long-duration fire, or several concurrent fires. Existing procedures to guide managers through complex and dynamic risk analysis were not designed with this kind of long-duration fire in mind. The team found that managers performed within the context of their experience and training. Their actions were reasonable based on what they knew and what they expected to happen and the policy available to guide their decisions.

With the benefit of hindsight there are key lessons to be learned from the management of the Mill Flat Fire. Among those lessons that should be considered by mangers:

Safety:
The identification and management of risk to firefighters was consistently the highest priority, and this diligence to minimizing human risk exposure contributed to the most important outcome; there were no fatalities or serious injuries as a result of the management of the Mill Flat Fire.

Fire Behavior:
Fire behavior projections have a shelf life. Early modeling provided predictions that informed management decisions in late July and early August, but as live fuel moisture conditions changed the earlier projections were no longer accurate or reliable.

Policy:
Late breaking changes in policy interpretation, new terminology and new decision support software should be seen as a red flag. While these changes just prior to the onset of western fire season were not determined to be responsible for negative outcomes at Mill Flat, it added to the overall confusion and uncertainty and was often a barrier to communication internally and externally. The Wildland Fire Decision Support System (WFDSS) was new in 2009, and there were issues related to clarifying objectives and strategies within WFDSS as it differs from the old system in several important ways. A protocol to guide risk-assessment and decisions on long duration fires would benefit fire managers nationwide.

Situational Awareness:
Managers on the Dixie National Forest have a great deal of experience in successfully managing unplanned ignitions, and one of the results of that history is an expectation of success. Fire managers expected a positive result, fostering a “can do” attitude among the staff in which people who felt concerns about the fire did not feel they could speak up. This view became a lens through which information was filtered, to some extent de-emphasizing concerns raised by the public, obscuring indicators that may have pointed toward changing conditions, and emphasizing the importance of data that supported their vision of a successful outcome.

The body of the report details the chronology, the environmental and policy conditions that set the stage for fire managers, and report of lessons learned, including observations made by the participants interviewed by the team and lessons learned and recommendations from the review team.

Chronology

July 25-August 18, 2009

The Mill Flat Fire started July 25, 2009 by lightning in the Pine Valley Wilderness on the Dixie National Forest. The initial size up of the fire was conducted on July 26, 2009 by helicopter due to inaccessibility and weather conditions on July 25, 2009. The fire was in rugged terrain with limited access and few safety zones for firefighters. The fire was managed by the local district in a Type 4 Incident Management structure. It was decided on July 26, 2009 to manage the fire including objectives to achieve resource benefit as defined in the Dixie National Forest Land Management Plan (LMP)- reducing fuel accumulation and allowing for aspen to be brought back into the ecosystem. The fire was monitored by helicopter and showed minimal growth and low fire activity from July 25, 2009-August 10, 2009. The chronology identifies acreage by date, as provided by the final progression map (see Appendix C for the progression map; see Appendix D for a detailed chronology).

On August 11, 2009 smoke was visible in the community of New Harmony and from Cedar City, Utah (3-25 miles away). The fire grew to seven acres, showing limited torching and short range spotting with one to two foot flame lengths on the ground. An initial FSPro analysis (a computer program that calculates the probability of fire spread from a current fire perimeter for a specified time period) was requested to show the probability and direction of spread and potential size of the fire. The analysis performed by a fire behavior specialist was completed on August 14, 2009.

By August 17, 2009 the fire had grown to 121 acres. Fire was creeping along the ground and isolated torching was observed by fire managers when they flew over the fire. The fire was moving north and staying on the ridge tops.

August 19-22, 2009

The fire continued to grow to 406 acres to the northeast by August 19, 2009 with active surface fire and isolated torching, resulting in closure of the Summit Trail from Mill Flat north. A new FSPro run was requested, but it was determined that the original analysis was still valid and sufficient with the weather forecast for the upcoming weekend. The fire activity continued to create columns of smoke visible from surrounding communities, generating interest from residents.

The fire was assessed on the ground on August 21, 2009 at 589 acres. The fire was burning in dead fuels within aspen and mixed conifer stands and holding when reaching meadows and mountain mahogany stands. Onsite weather observations and weather data from the Enterprise Remote Automated Weather Station (RAWS) were used to determine local weather affecting the fire.

August 23- 24, 2009

By August 23, 2009 the fire had grown steadily to 971 acres. A Type 2 initial attack fire crew was assigned to clear the New Harmony fuel break as part of contingency planning. The crew was directed to open up the strips that had been untouched during previous treatments. The crew was unable to complete the fuels reduction because they were re-assigned on August 24, 2009 to another fire that was deemed a higher priority.

August 25-26, 2009

A Type 1 helicopter (a large helicopter that can deliver large volumes of water on a fire) and a fire use module were ordered on August 25, 2009 to the fire. The fire was flown by helicopter and a new WFDSS decision including finalized management action points (see Appendix A) and a revised planning area boundary was published. Management action points are "trigger" points on the ground where specific actions may be needed. Management action points had been in draft form since August 19, 2009.

On August 26, 2009 forest staff conducted a town hall meeting in New Harmony to inform the community of the fire situation, management action points, and to field questions and listen to concerns. Additional hand crews and engines were assigned to work on the fuel break west of New Harmony. Another FSPro run was requested, but the analyst was not able to complete the necessary calibrations due to a lack of current information.

August 27-28, 2009

On August 27, 2009 the fire was burning in mountain mahogany fuels near Straight and Dam Canyons and had reached the management action point in Straight Canyon (see Appendix A). The Type 1 helicopter was assigned to suppress/slow the fire in Straight and Dam canyons.

The Type 1 helicopter was used for the entire operational period on August 28, 2009 to keep fire that was on the slopes of Dam and Straight Canyons from becoming established in the bottoms of the canyons.

August 29, 2009

Dry fuels and low relative humidity caused the fire to grow to 1,401 acres. By mid-day August 29, 2009, fire had established itself at the top of Dam and Straight Canyons and was burning in mountain mahogany. Lack of visibility because of smoke decreased the effectiveness of the Type 1 helicopter. After a helicopter flight at 1415, the decision was made to order a Type 3 Incident Management Team (IMT) and additional resources though they would not assume command of the fire until the next morning.

Extreme fire behavior led to rapid fire movement downhill towards New Harmony. The Incident Commander ordered all resources to attempt to complete the fuel break and to do preparation work around the structures, and evacuate the area. After completing a complexity analysis, the Incident Commander ordered a Type 1 IMT at 1635. Air tankers called to the scene were unable to operate in front of the fire at the fuel break due to safety concerns with smoke, high winds, and turbulence. A burn out operation began around 1815, firing off of the fuel break. As extreme fire behavior on the main fire front approached the fuel break, it became unsafe for the firing operation to continue and all of the personnel and equipment were pulled out by 1935. The fire front and spot fires breached the fuel break by 2026 and fire actively burned in the town of New Harmony.

By 2100 it was confirmed that three residences (one primary and two secondary) were destroyed, three additional residences were significantly damaged, and seven other structures including outbuildings and corrals were burned. Twenty additional buildings were threatened. At 2217 a red flag warning was issued for fire weather conditions. The fire burned throughout the night and no additional structures were lost. By 2245 the fire activity had decreased in the town.

August 30-31, 2009

On August 30, 2009 fire management transitioned to a Type 3 team at 0745. At 0830 the fire perimeter had grown to 6,205 acres. By the evening of August 30, 2009 the fire had grown to 7,641 acres. Fire activity continued to threaten homes with torching, running and aggressive surface spread. A town meeting was held and residents expressed their concerns. The fire was fought through the night and no additional structures were lost.

On August 31, 2009 at 0600, fire management transitioned to a Type 1 Incident Management Team.

Conditions

This section provides an overview of conditions related to the Mill Flat Fire to provide context for the lessons learned identified by the participants and the team. The team identified two conditions to discuss in detail as they provide perspective to the operational environment on the Mill Flat Fire.

1) Environmental Setting - the fire environment and resulting fire behavior and

2) Policy Setting - changes to Federal Fire Policy Implementation Guidance and wildland fire decision processes.

Environmental Setting:

Fire Behavior Summary

The Mill Flat Fire was discovered on July 25, 2009 and during the first 18 days the fire grew to 7 acres. Over the next 17 days, the fire displayed regular growth, reaching 1,401 acres by August 29 at 1400. When the fire began its rapid move that afternoon, the maximum rate of spread downhill was estimated at over one mile per hour. The resulting single day growth was 3,852 acres for a total fire size of 5,253 acres. Many fire personnel stated that they had not expected such extreme fire behavior.

When the fire started, the Energy Release Component (ERC) was just below average for that time of year. The Energy Release Component is a measure of potential fire intensity from live and dead fuels at the head of a fire. Over the next several weeks the ERC continued to increase until it reached near record highs peaking above the 90th percentile on August 29th (Appendix F).

The Color Country high elevation Fuel Model G pocket card that is posted on the National Wildfire Coordinating Group (NWCG) website *(see Appendix G)* identifies local thresholds for Energy Release Component levels for areas above 7,000 ft. It states:

> *"…a combination of any of these factors can greatly increase fire behavior: 20' wind speeds over nine mph, relative humidity below 12 percent, temperatures over 80 degrees, Haines Index of 5 or 6".*

These conditions were all predicted and observed on August 29th (see Appendix H).

The Fire Environment

Fuel Type

The fuels where the fire started and in which it burned for the first 35 days were timber stands of mixed conifer with heavy dead and down fuel loadings (see Figure 1). Fire behavior in this fuel type produces high intensities (flame lengths) but is characterized by less rapid rates of spread, which is consistent with the burning that was observed.

On August 29th the fire had moved from the timber fuel type into a brush fuel model. Fire would be expected to carry in the woody shrubs and shrub litter with a high spread rate and very high flame lengths. Given the right live fuel moisture, spread rates for this fuel would be expected to be as high as two 2.5 mph and flame lengths can be as much as 25 feet.

Fuel Moisture
Live fuel moistures and 1,000 hour fuel moistures were sampled on August 28, the day before the fire made its major run. Samples were taken at various elevations, on top near the fire lower down in the valley (see Appendix E). Although no study could be found that shows critical live fuel moisture levels for Curlleaf Mountain Mahogany (*Cercocarpus ledifolius)*, conditions on August 29th were appropriate for rapid combustion. Both locations were well below the 90th percentile level and getting close to the 60th percent level.

Topography
The fire started at 8,900ft elevation and the terrain could best be described as rolling to flat with little elevation change. The fire burned in an area known as Flat Top Mountain. By August 29, 2009 the fire had burned most of Flat Top Mountain and the topography was changing to steeper down slopes that enter prominent canyons, one to the north and one to the south of the fire. Both canyons flow to the east and connect just above New Harmony and are fairly linear (hence the name "Straight Canyon"). These straight canyons were very important features in terms of fire behavior because they would ultimately funnel southwest winds into New Harmony (see Appendix E).

Weather
The Enterprise Remote Automated Weather Station accurately represented the weather affecting the fire. The three main weather factors affecting the fire behavior were wind, relative humidity (RH) and the Haines Index. The Haines index measures atmospheric stability (Haines, 1988) on a scale of 1-6, with six being the most unstable.

The spot weather forecast issued on the afternoon of August 28, 2009 predicted for the afternoon of August 29, 2009 temperatures of 82-84 degrees, winds out of the southwest five to ten mph increasing to 10 to 15 mph, relative humidity of 13-15 percent, and a Haines Index of 6 high (see Appendix H). The actual weather readings for relative humidity were lower and the winds were slightly higher than forecasted. The relative humidity fell below 10 percent, therefore the potential for extreme fire behavior was elevated. With the Haines Index of six high it was probable that a plume dominated fire could occur, resulting in extreme fire behavior. The winds were not strong enough to develop a classic wind driven fire, although sufficient enough to contribute to extreme fire behavior. Using wind data from August 29, 2009 the review team ran models to predict normal wind patterns for the area; the models showed that, under these circumstances, winds are likely to channel down the two canyons (see Appendix E).

Policy Setting:

Federal Wildland Fire Policy and the Wildland Fire Decision Support System (WFDSS)

Prior to the 2009 western fire season, the Forest Service made changes to the Implementation Guidance for the Federal Wildland Fire Management Policy and wildland fire decision processes (see Appendix I for additional details and a chronology of changes).

The primary changes in the revised implementation guidance were:

- Changes in terminology.
- A wildland fire may be concurrently managed for one or more objectives and those objectives can change as the fire spreads across the landscape, encountering new fuels, weather, social conditions, and land ownership.

The revised Implementation Guidance also reaffirmed the need to work collaboratively with State, local and tribal fire managers as well as public and non-governmental organizations in the management of wildland fire. The guidance emphasizes the need to prepare fire management plans which are intergovernmental in scope and at a landscape scale and help prepare for the eventuality of wildland fire.

The revised policy allows fire managers to manage a fire for multiple objectives and increase managers' flexibility to respond to changing incident conditions and firefighting capability while strengthening strategic and tactical decision implementation supporting public safety and resource management objectives.

On February 2, 2009, Forest Service Deputy Chief Hubbard announced the implementation schedule for the Wildland Fire Decision Support System (WFDSS); a web-based fire analysis application. Use of the WFDSS was to be phased in nationally between April 2009 and September 2009. Beginning April 1, 2009, agency administrators were authorized to use the WFDSS decision analysis process and the Decision Analysis Report (DAR), for unplanned wildland fires in lieu of the three existing decision analysis processes. Full transition to the DAR was to be complete for Region 4, including the Dixie National Forest, by July 1, 2009 for those fires requiring one of the current decision analysis processes, including all unplanned wildland fires which are managed for multiple objectives. By September 1, 2009 all agency field units were to be entering all unplanned wildland fires into the WFDSS system, in addition to using the DAR.

The Interagency Fire Management Plan (FMP) for the Dixie National Forest, Bryce Canyon National Park and Cedar Breaks National Monument was finalized on May 15, 2009. Guidance for the transition to the WFDSS and the revised fire policy implementation guidance were incorporated into the FMP as well as could be expected given the short time frame from the release of the revised guidance. The FMP retained many of the elements and terminology that were developed in support of the Wildland Fire Use program including use of a Fire Use Manager (FUMA) and a Fire Size-Up and Decision Checklist (FMP page 35).

Lessons Learned

A foundational principle of high-reliability organizing (see Appendix J for the five principles of mindfulness) is a commitment to continuous learning. Learning from success is important but learning from events with unintended outcomes is critical. The Team examined processes, actions and activities on the Mill Flat Fire to maximize learning opportunities. The intent of this review is to improve future performance by generating individual, unit and organizational lessons learned that are based on the observations of the participants and the Team.

Reflections by Participants:

Lessons Learned

This section presents a compilation of views expressed by those involved with the management of or affected by the Mill Flat Fire. These comments were used by the team to formulate Key Lessons and Recommendations (in the next section).

Comments were categorized by the team into the following themes:

- Fire Behavior
- Situational Awareness
- Relations/Communications
- WFDSS and risk-based decision making
- Policy

Fire Behavior

Fire managers placed too much reliance on FSPRO, they didn't update models after fire activity increased. The potential for the fire to impact New Harmony was known to be a possibility. However, FSPRO from August 14, 2009 showed a lower probability that the fire would spread to New Harmony and that it would take at least a few days. This gave the impression that there was ample time to accomplish what needed to be done to protect the community.

Situational Awareness

The Fuel Break was inadequate: There were many elements of the fuel break that made it an inadequate control line to protect the community of New Harmony.

- The fuel break had not been maintained for years and required a great deal of work to clear out brush that had become re-established.
- The original design of the fuel break required all vegetation to be left in the drainages. This resulted in two "wicks" that, if left untreated, provided a clear path for the fire to cross. Clearing the drainages also required a great deal of work.
- The fuel break was built on the USFS property boundary; in many cases this was not best tactical location to be effective.
- The width of the fuel break was not adequate for the fire behavior that occurred.
- The fuel break was never intended to "stop" a fire but rather to reduce fire intensity to a more manageable level by reducing fuel loading and breaking the continuity between the wildlands and the community. Consequently, when it had to be used as a control line there was a great deal of work that needed to be done.

Order Fire Behavior Analysts (FBAN) and Long Term Analysts (LTAN) when fire is established and will be a long term event to help increase situational awareness.

- Additional information was needed to accurately predict fire behavior and assist with long term planning. An FBAN/LTAN would have likely identified many of the elements that led to the fire behavior experienced on August 29, 2009.

Shadowing provides a great opportunity to validate and extend decision making.

- On August 29, 2009 when the fire was most active and threatening New Harmony, firefighters were in the difficult position of having to make critical decisions under extreme conditions. One can only assume that some of these decisions were not made with the benefit of having "all" the information needed, but with the best information available at the time. Any situation like this naturally causes doubt and second guessing. Some members of the Type 3 team did shadow the Type 4 team and the additional persons helped gather information, validate decisions, and built confidence. It also provided someone to assign tasks to when things got busy. This eliminated distractions and allowed decision makers to concentrate on more critical matters.

Having a fresh set of eyes on the incident was helpful.

- Personnel assigned to the incident for an extended period had become complacent after weeks of witnessing fairly benign fire behavior. They had developed perceptions of how the fire was going to behave, the threat to the community, the resources and tactics needed based on those observations. Personnel new to the incident viewed the same situation with a much greater sense of urgency and recommended additional resources and a more aggressive approach.

Activate the Type 3 Incident Management Team immediately, order resources sooner, do not wait for formal briefing in emergency situations.

- There was a delay in ordering the Type 3 team. Fire managers thought they had more time before the fire reached New Harmony. It was known that a Type 1 team had already been ordered and that the Type 3 team would only be in place until they arrived.
- If on scene sooner, the Type 3 team could have provided a safer and more efficient span of control for operations, managed incoming resources, begin to establish logistical support, and help build an action plan. Once ordered, the team did not take the fire until the following day after receiving a formal in briefing, delegation of authority, and doing a formal transition at the beginning of the operational period. The need for assistance in this case was immediate. As noted above, key members of the Type 3 team's operations section were made available to shadow members of the Type 4 organization until the official transition. This was a positive move which helped the Type 4 organization manage the incident until the transition to the Type 3 team.

Be cautious with early season starts.

- The earlier in the season a fire is allowed to burn freely, the greater the period that it will have the potential to become a problem. This should be a consideration when determining management strategy, particularly when the fire has the potential to become a long term event. It should be noted that the time of year this fire started is generally considered late in a normal fire season for Color County.

Not all personnel expressed their doubts and concerns.
- Several folks interviewed shared that although they had concerns or doubts about continuing with the strategy to manage the Mill Flat Fire after August 25, 2009, they did not speak up.
- Others wondered at about that same time period "have we met our objectives for this fire? Should we suppress it now?" and didn't raise the question.

Relationships/Communications
Fire Wise Works! Clearly homes that were saved during this fire were protected by fire wise actions.

The New Harmony community Wildfire Protection Plan is outdated and needs to be revised.

The Sheriff should be involved in evacuation planning to ensure they have knowledge and ownership in the plan when needed.

Reverse 911 is a great concept, but in this case did not work as planned. The Reverse 911 needs to be improved.

Locals stationed at roadblocks were very effective in communicating with the locals who were evacuated.

WFDSS and Risk Based Decision Making
Fire personnel were of the opinion that although the roll-out of revised fire policy implementation guidance and WFDSS was not very smooth, the transition did not contribute to the final outcome.
- A lot of the pieces related to the changes were lacking including guidance for Delegations of Authority and Burned Area Emergency Rehabilitation. There was some confusion about the role of the Strategic Operational Planner (SOPL) and the position's relationship to the Unit Duty Officer and Incident Commander (IC). There was a perception that the SOPL and the Duty Officer were one in the same.
- The timing of the implementation schedule for the revised guidance and WFDSS was awkward for fire managers and their partners due to the Forest's early fire season. The changes in the terminology were difficult to fully incorporate into the FMP and communicate with the public.
- Although WFDSS provides a good vehicle to assist in documenting some of the discussions relevant to management decisions, there was difficulty incorporating other support tools (Decision Checklists, Relative Risk Ratings, etc.) into the documentation.
- The doctrinal approach provides a lot of flexibility in deciding what information is important to the decisions but to a degree some personnel missed the structure and expectations that were in place for WFIPs and WFSA.
- Fire managers were reluctant to make new decisions in WFDSS because they remembered how difficult WFSAs were. With more experience with the system the decision process became easier.

Policy Implementation-(Federal Wildland Fire Policy and Resource Management Policy)
"Resource Benefit Fires" are not always the least cost option. A choice to manage a fire (other than full suppression) is a commitment to investing in the fire. Fire managers need to staff appropriately given values at risk.

Perceptions associated with labels assigned to fires, e.g. resource benefit, fire use, full suppression, etc. cause confusion for fire

managers, partners, firefighters and the public. The perceptions deal with expectations related to cost, resources utilized, strategy and tactics.

Wilderness and fire managers need to have a better understanding of relevant policy direction for fire in wilderness areas, including prescribed fire applications, use of mechanized equipment and retardant and how it relates to fire policy. The Forest has specialists that are experts on wilderness policy that would be an excellent source of information on what can and can't be done in the wilderness and the processes required for approval. The communication between fire managers and wilderness specialists could be improved for both sides to gain an understanding of the rules governing wilderness and the goals and objectives of each party. The public and our cooperators need to have a better understanding of the relationship of wilderness and fire management policy.

Lessons Learned and Recommendations from the Team

During the After Action Review the firefighters identified and documented multiple lessons learned. Interviews with community members led to additional learning as did further study of the incident by the team.

This section presents a listing and brief explanation of the Team's observations as to key issues, decisions, interpretations and actions associated with the management of the Mill Flat Fire. Where appropriate, the Team has made recommendations.

They are categorized by the following themes:

- Fire Behavior
- Situational Awareness
- Relationships/Communications
- WFDSS and Risk Based Decision Making
- Policy

Fire Behavior
Key Lessons:
An FSPro run projecting four weeks of potential fire spread was done early in the fire's management but was not updated when the fire had significant growth in late August. An updated FSPro run had been requested but had not been completed. Other fire behavior prediction tools may have shown a greater potential for the fire reaching New Harmony (see Appendix K), but were not used.

Critical thresholds for live fuel moisture were not known for Curlleaf Mountain Mahogany, which proved to be a key fuel component.
There was not a fire behavior analyst assigned to the Mill Flat Fire, or available locally to assist. The lack of an analyst limited the availability of current, relevant data regarding expected fire behavior.

Fire Behavior
Recommendations:
FB 1: Significant fire growth should trigger an update in fire behavior analysis. Establish criteria for long-duration fires to identify trigger points, identifying conditions or sets of conditions that prompt updating risk assessments and modeling. Use the full range of analysis tools available to support decisions.

FB 2: Monitoring and modeling dynamic live fuel moistures is critical in our ability to consistently assess potential fire behavior and changing risk on long-duration fires. Analysts must be aware of critical live fuel thresholds where extreme spread through live fuels threatens assets.

FB 3: Fire behavior analysis skills need to be developed and enhanced locally, regionally and nationally as this is a systemic and ever-increasing need. Develop a pool of qualified fire behavior analyst skills to support fire management, and request assistance when needed.

Situational Awareness
Key Lessons:
Management action points were established, but were put in place too late in the incident's development when tactical options were limited. Once the fire became established in Straight and Dam Canyons the only option was to attempt to stop the fire at the fuel break.

Fire managers were optimistic that they would be successful, focused on the resource benefit aspects of the fire. Because current fire behavior projections were not available, the time needed to complete

improvements to the fuel break was not understood. Managers didn't recognize the potential for the fire to move rapidly toward New Harmony.

There should be a comprehensive national protocol to evaluate changing risk on long duration fires and guide managers through complex decisions.

There was confusion about the duties and responsibilities of the Strategic Operational Planner (SOPL) position.

A Type 3 team was ordered after the fire began its rapid move.

Managers consistently and correctly identified risk to the public and firefighters and took actions that were consistent with managing risk exposure.

The fuel break was not designed for the kind of fire behavior experienced on August 29th. There were many elements of the fuel break, including location, design, and vegetative growth since its most recent treatment that rendered it an inadequate control line to protect the community of New Harmony.

Situational Awareness
Recommendations:
SA 1: Management action points must be identified and documented early in the incident with established trigger points for additional analysis, new decisions, additional resources and additional actions, including when to review and update management action points.

SA 2: Plan for the unexpected. Base actions on values at risk and potential consequences in the event that things go wrong.

SA 3: Clarify roles in leadership and strategic support positions on the fire. The SOPL role is not a command position in ICQS.

SA 4: Challenge assumptions regarding fuels and weather regularly throughout the incident. The resources required to manage the fire changes with fire behavior and complexity, including the need for different levels of command.

SA 5: Continue to emphasize firefighter and public safety as the number one priority.

SA 6: Continue to work with the State, Counties and communities on high priority hazardous fuels reduction projects designed for the kind of fire behavior that might be expected.

Relationships/Communications
Key Lessons:
Community members expressed that *"they were made to feel silly"* for being concerned, and that they were being fed *"propaganda"* about the benefits of the fire.

Community members said that the "*Blue Springs Fire did the same thing and they told us that fire was OK, too. We have lost trust in the Forest Service"*.

Color Country has a long history of strong interagency partnerships. With a new interpretation of fire policy and our relationships evolving, some State partners did not feel fully engaged in the fire's management. They were well and frequently briefed on the fire's status, but did not become fully involved in devising strategies and making decisions. There is still confusion among the partners about how early involvement will be perceived for those fires that ultimately have high costs or losses.

Some people did not speak up when they had concerns.

Relationships/Communications Recommendations:

R/C 1: Continue to work with the New Harmony community as well as other communities in your wildland urban interface areas in partnership with the State, Counties and Local agencies. Discuss plans for rehabilitation. Invite the participation of agencies that have resources to help private landowners, such as the Natural Resources Conservation Service (NRCS). Begin work on improving the fuel break. Support the update to the Community Wildfire Protection Plan (CWPP) for the community of New Harmony. These actions will contribute to rebuilding trust.

R/C 2: Strive to engage all parties with a stake in the fire. Agency and community partners are most effective if engaged in devising strategies or decision making, rather than simply being briefed. Use a collaborative approach; avoid a "we know best" attitude. Support these efforts with continued pre-season discussions with States and partners, including developing parameters to guide cost agreement discussions for long-duration fires.

R/C 3: Maintain and find ways to reinforce Color Country's highly functioning interagency partnership.

R/C 4: Forest Leadership must continue to strive for a culture that encourages learning and questioning, internally and externally.

WFDSS and Risk Based Decision Making Key Lessons:

The strategic and incident objectives in early WFDSS decisions (Appendix A) were inadequate to guide development of strategic direction or course of action for the incident. Values at risk were not articulated. By the time the clear incident objectives were established, tactical options were limited.

The distinction between objectives, requirements and strategic direction and incident direction was not clear in incident decisions. Although the Dixie National Forest Fire Management Plan provides an excellent summary of relevant land and fire management guidance and considerations, the Fire Management Unit (FMU) strategic objectives and requirements were not fully incorporated into the decisions for the Mill Flat Fire (Appendix A).

WFDSS is inflexible for management of strategic objectives and requirements, so managers were reluctant to include objectives that only applied to parts of a larger fire management unit (FMU) because some direction is not applicable to every fire.

The unit completed several Relative Risk Assessments and documented key discussions and decision points related to the incident in the Key Decision Log (KDL). However, they were not incorporated into the incident documentation in WFDSS because these systems are currently not compatible.

WFDSS and Risk Based Decision Making Recommendations:

WFDSS 1: Clearly articulate objectives for every incident and identify values at risk. Conduct relative risk assessments with a group of resource specialists rather than as an individual exercise.

WFDSS 2: Any management response to a wildland fire on National Forest System land will be based on objectives established in the applicable Land/Resource Management Plan and incorporated in decisions in WFDSS.

WFDSS 3: Modify the WFDSS platform to allow users flexibility in "activating" or "deactivating" strategic objectives and requirements specific to the incident. Where WFDSS is inflexible incorporate relevant FMP/FMU Guidance into the decision documentation to guide the development of meaningful incident objectives and requirements and strategic direction for each incident.

WFDSS 4: Make Relative Risk Assessments and the Key Decisions Log part of WFDSS.

Policy Implementation Key Lessons:

Multiple terms for various management options for wildland fire confused agency personnel, partners, and the public. "Fire for Resource Benefit", "Suppression Fire" and "Benefit Fires" are terms and ideas that continue to narrow our vision. Labels can narrow one's vision of management options and perhaps contribute to reduced situational awareness.

Not all of the participants in the Mill Flat Fire decision process had a clear understanding of some of the resource management and fiscal policies relevant to fire management. There were misconceptions among the participants regarding the interactions between wilderness and fire management policy. Guidance that is not grounded in the Forest Service Manual (FSM) or Forest Service Handbook (FSH) is applied to management via letter without the benefit of full interdisciplinary review. Guidance, posted on websites and other sources could be perceived as being a recommendation or a good idea or a "must do" practice.

There were signs of poor communication and lack of knowledge between fire managers and resource managers, especially regarding wilderness issues. Questions regarding appropriate use of suppression funds to prepare the New Harmony fuel break were not elevated to obtain a correct interpretation. There was reluctance to implement the work on the fuel break too early, concerned that it would be viewed as "fuels work" rather than a necessary action for the successful management of the incident if that management action point were never activated.

Policy Implementation Recommendations:

Policy 1: Our response to wildland fire must be based on an awareness of ecological, social, fiscal and legal consequences, the cause of the fire and the likely consequences on firefighter and public safety and welfare, natural and cultural resources and values to be protected; not on terminology. Any ecological benefits derived are an outcome that should be evaluated "after the smoke clears".

Policy 2: Provide interdisciplinary review of FSM and FSH guidance to clarify recommended versus required practices. The Washington Office should complete the effort to review and revise all manuals and handbooks to reflect the updated *Guidance for Implementation of Federal Wildland Fire Management Policy*. This review should not be limited to FSM 5100 only, some FSM guidance, including FSM 2324.2, does not even reflect the June 2003

federal wildland fire management fire policy guidance changes.

Policy 3: Develop an overarching national protocol to guide risk assessments and complex decision making for long-duration fire management.

Policy 4: The forest should improve understanding of policies regarding fire management relevant to all resource areas.

Conclusion

The review team was asked to document the lessons learned from the Mill Flat Fire for distribution among the land management and fire management community. The team found that managers performed within the context of their experience and training. Their actions were reasonable based on what they knew and what they expected to happen and the policy available to guide their decisions.

Fire managers consistently made firefighter and public safety the highest priority on the Mill Flat Fire. Strong interagency relationships helped communicate with partners on fire status. Findings in this document should be used to improve future performance and be a tool for learning.

Our hope is that the lessons learned from Mill Flat will help us avoid the damage and disruption of lives that the residents of New Harmony experienced.

Glossary

After Action Review (AAR) - A professional discussion of an event, focused on performance standards, that enables Agency Administrators and firefighters to discover for themselves what happened, why it happened, and how to sustain strengths and improve on weaknesses. An After Action Review is a tool incident command personnel and units can use to get maximum benefit from every incident. It provides a daily review of the day's actions: - Identify and discuss effective and non-effective performance. Candid insights into specific firefighter, leader, and unit strengths and weaknesses from various perspectives. Feedback and insight critical to actions that were not standard operating procedures or those that presented safety problems. Lessons learned and how to apply them in the future.

Decision Analysis Report (DAR) - represents the compilation of all WFDSS subsection information into a single report that becomes the formal decision documentation for the incident.

Energy Release Component (ERC) - a measure of potential fire intensity from live and dead fuels at the head of a fire.

Fire Behavior Analyst (FBAN) - The FBAN focus is on short duration (24-72 hour) fire behavior predictions in emergency wildland fire situations usually on Type 1 or 2 Incident Management Teams managing numerous suppression forces with assigned on-the-ground resources. Their emphasis is on tactical operations and how fire behavior affects suppression capabilities, fireline suppression risks, and firefighter safety.

Fire Management Plan (FMP) - A strategic plan that defines a program to manage wildland fire and prescribed fire and documents the fire management program in the approved land use plan.

Fire Spread Probability (FSPro) - is a spatial model that calculates the probability of fire spread from a current fire perimeter or ignition point for a specified time period.

Fire Use Manager (FUMA) - A Fire Use Manager is responsible for incident activities involving managing wildland fires use to achieve resource management objectives including developing and implementing strategic plans and allocating resources.

Fuel - Fuel is comprised of living and dead vegetation that can be ignited. It is often classified as dead or alive and as natural fuels or activity fuels (resulting from human actions, usually from logging operations). Fuel components refer to such items as downed dead woody material by various size classes, litter, duff, herbaceous vegetation, live foliage, etc.

Fuel Class - A set of fuels with similar traits. Fuels are categorized as herbaceous or woody and live or dead. Dead fuels are classed as 1-, 10-, 100-, or 1,000-hour time lag fuels, based on the time needed for fuel moisture to come into equilibrium with the environment:

1-hour timelag fuels: Dead fuels comprised of herbaceous plants or woody plants less than about 0.25 inch (6.4 mm) in diameter and the surface layer of litter on the forest floor.

10-hour timelag fuels: Dead fuels comprised of wood from 0.25 to 1 inch (0.6-2.5 cm) in diameter and the litter from just beneath the surface to around 0.75 inch (1.9 cm) below ground.

100-hour timelag fuels: Dead fuels comprised of wood from 1 to 3 inches (2.5-7.6 cm) in diameter and litter from around 0.75 to about 4 inches (1.9-10 cm) below ground.

1,000-hour timelag fuels: Dead fuels comprised of wood from 3 to 8 inches (7.6-20.3) in diameter and the forest floor layer >4 inches (10 cm) below ground.

Incident - An occurrence or event, either natural or person-caused, which requires an emergency response to prevent loss of life or damage to property or natural resources.

Incident Commander (I.C.) - This ICS position is responsible for overall management of the incident and reports to the Agency Administrator for the agency having incident jurisdiction; the leader of an incident command team. This position may have one or more deputies assigned from the same agency or from an assisting agency(s).

Incident Command System (ICS) - The combination of facilities, equipment, personnel, procedures, and communications operating within a common organization structure with responsibility for the management of resources to effectively accomplish objectives determined for an incident.

Long Term Fire Analyst (**LTAN) -** is responsible for acquisition and analysis of environmental and fire behavior information to develop recommendations and issue forecasts with short and long-range projections.

Management Action Points (M.A.P.'s) - Geographic points on the ground or specific points in time where an escalation or alternative of management actions is warranted. These points are defined and the management actions to be taken are clearly described in an approved Wildland Fire Implementation Plan (WFIP) or Prescribed Fire Plan. Timely implementation of the actions when the fire reaches the action point is generally critical to successful accomplishment of the objectives. Also called Trigger Points.

Maximum Management Area (MMA) - The maximum geographic limits of spread within which a wildland fire use fire is allowed to spread.

Objective - A concise, time-specific statement of measurable, planned results that respond to pre-established goals. An objective forms the basis for further planning to define the steps to be taken and the resources to be used in achieving identified goals.

Operational period - A defined time period, e.g. 0600 to 1800 hours, in which a specific set of objectives are established for managing incident activities and for which specific resources and personnel are assigned to those activities; also referred to as a "shift".

Resources - Personnel and major items of equipment available or potentially available to be assigned to incidents. Resources are described in the incident command system by kind and type.

Suppression - A management action intended to extinguish a fire or alter its direction of spread.

Type - A classification of resources in the incident command system which refers to capability. Type 1 is generally considered to be more capable than Types 2, 3, or 4, respectively, due to size, power, capacity, or in the case of incident management teams, experience and qualifications.

Wildland Fire - Any non-structure fire, other than prescribed fire, that occurs in the wildland. This term encompasses fires previously referred to as *wildfires* and *prescribed natural fires*.

Wildland Fire Decision Support System (WFDSS) - A web-based application for analyses and reports for the federal wildland fire organization.

Wildland Fire Implementation Plan (WFIP) - A progressively developed assessment and operational management plan that documents the analysis and describes the appropriate management response for a wildland fire.

Wildland Fire Situation Analysis (WFSA) - A decision making process which evaluates alternative management strategies against selected safety, environmental, social, economic, political, and resource management objectives as selection criteria, and provides a record for those decisions.

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Appendix A: Incident Objectives/Incident Requirement Lists and Management Action Points (M.A.P's)

Initial Decision July 27, 2009

Incident Objective List

Active	Inactive	Incident Objective
07/27/09		In designated wilderness natural processes will be able to assert their role
07/27/09		Increase the number of acres burned annually by natural ignition consistent with the safety of human life, property and other resource values.
07/27/09		Keep fire suppression costs commensurate with resource values through the use of appropriate response actions.
07/27/09		Maintain fire dependent ecosystems using wildland fire ignited naturally.
07/27/09		Minimize the number of fires on which suppression actions are taken.
07/27/09		All mechanized equipment used during suppression activities needs to be recorded in INFRA for each fire by type and quantity used.
07/27/09		Monitor the fire from the ground and from the air, to evaluate fire spread and fire behavior. If fire behavior is not meeting resource objectives, take suppression actions including the use of mechanical devices if needed to protect fire fighter safety.

Incident Requirement List

There are no Incident Requirements.

Strategic Objective List

Unit/ FMU	Active		Strategic Objective	
UTDIF/ Always	06/14/09	Standard	Human life (firefighter and public safety) is the highest priority during a fire. Once firefighters have been assigned to a fire, their safety becomes the highest value to be protected. Property and natural and cultural resources are lower priorities	Utah Fire Amendment 2001, Appendix 7, pg A-35
UTDIF/ Always	06/14/09	Standard	Human-caused fires (either accidental or arson) are unwanted wildland fires and will be suppressed. Natural ignitions will be suppressed in areas not covered by an approved fire management plan.	Utah Fire Amendment 2001, Appendix 7, pg A-35
UTDIF/ Always	06/14/09	Guideline	When assigning protection priorities to property and natural and cultural resources, decisions will be based on relative values to be protected, commensurate with fire management costs.	Utah Fire Amendment 2001, Appendix 7, pg A-35
UTDIF/ Always	06/14/09	Goal	Ecosystems are restored and maintained, consistent with land uses and historic fire regimes, through wildland fire use and prescribed fire.	Utah Fire Amendment 2001, Appendix 7, pg A-35

Management Requirement List

There are no Management Requirements.

Courses of Action

Content

Strategic Direction List

Active	Inactive	Strategic Direction

Strategic Direction List

07/27/09	Follow the pre-planned response
07/27/09	Monitor incident
07/27/09	Allow fire to burn while it is meeting resource objectives and remains within the wilderness boundary.

Rationale

Content

This fire is burning in the wilderness, with minimal values at risk. This area has also been identified by the fire ecologist as an area in which fire could be used to help bring Aspen back into the ecosystem.

Updated Decision with M.A.P's August 25, 2009

Incident Objective List

Active	Inactive	Incident Objective
07/27/09		In designated wilderness natural processes will be able to assert their role
07/27/09		Increase the number of acres burned annually by natural ignition consistent with the safety of human life, property and other resource values.
07/27/09		Keep fire suppression costs commensurate with resource values through the use of appropriate response actions.
07/27/09		Maintain fire dependent ecosystems using wildland fire ignited naturally.
07/27/09		Minimize the number of fires on which suppression actions are taken.
07/27/09		All mechanized equipment used during suppression activities needs to be recorded in INFRA for each fire by type and quantity used.
07/27/09		Monitor the fire from the ground and from the air, to evaluate fire spread and fire behavior. If fire behavior is not meeting resource objectives, take suppression actions including the use of mechanical devices if needed to protect fire fighter safety.
08/25/09		Preffered management actions should focus on keeping fire from spreading outside Wilderness near New Harmony if possible.

Incident Requirement List

There are no Incident Requirements.

Strategic Objective List

Unit/ FMU	Active		Strategic Objective	
UTDIF/ Always	06/14/09	Standard	Human life (firefighter and public safety) is the highest priority during a fire. Once firefighters have been assigned to a fire, their safety becomes the highest value to be protected. Property and natural	Utah Fire Amendment 2001, Appendix 7, pg A-35

Strategic Objective List

			and cultural resources are lower priorities	
UTDIF/ Always	06/14/09	Standard	Human-caused fires (either accidental or arson) are unwanted wildland fires and will be suppressed. Natural ignitions will be suppressed in areas not covered by an approved fire management plan.	Utah Fire Amendment 2001, Appendix 7, pg A-35
UTDIF/ Always	06/14/09	Guideline	When assigning protection priorities to property and natural and cultural resources, decisions will be based on relative values to be protected, commensurate with fire management costs.	Utah Fire Amendment 2001, Appendix 7, pg A-35
UTDIF/ Always	06/14/09	Goal	Ecosystems are restored and maintained, consistent with land uses and historic fire regimes, through wildland fire use and prescribed fire.	Utah Fire Amendment 2001, Appendix 7, pg A-35

Management Requirement List

There are no Management Requirements.

Courses of Action

Content

Strategic Direction List

Active	Inactive	Strategic Direction
07/27/09		Follow the pre-planned response
07/27/09		Monitor incident
07/27/09		Allow fire to burn while it is meeting resource objectives and remains within the wilderness boundary.
08/25/09		Keep fire above Straight Canyon and Dam Canyon with aerial resources as possible. Take control actions per MAP(s) identified. Keep fire within Wilderness Area on the northeast side near New Harmony as possible and take actions neccessary to prevent fire spread outside boundary as natural boundaries and firefighter safety allows. Allow fire to play natural role in the ecosystem within the planning area as long as it

continues to meet resource objectives. Monitor fire by air and ground, disseminate timely public information to surrounding area residents.

Management Action Point 1

NAME	VALUE
Incident Name	Mill Flat
Cost	$15,000
Shape	1
Activated	08/25/09
Deactivated	

Condition
Fire spread reaches the ridgetop on the east side of Flat Top Mountain and still has heat.

Actions
Asses the need to utilize a type 1 helicopter to make water drops on heat along fire edge to slow or stop potential spread to the east off the top of the ridge towards Dam, Straight, and/or Anderson Canyons.

Resources
Type 1 helicopter (HT718), ICT4, recon flights Type 3 helicopter

Management Action Point 2

NAME	VALUE
Incident Name	Mill Flat
Cost	$30,000
Shape	2
Activated	08/25/09
Deactivated	

Condition

Fire reaches rocky outcrop in Dam Canyon with active spread downhill/down canyon

Actions
Utilize heavy helicopter to drop water and suppress NE side of fire in Dam Canyon

Resources
Type 1 Helicopter, Type 4 IC, recon flights Type 3 helicopter

Management Action Point 3

NAME	VALUE
Incident Name	Mill Flat
Cost	$110,000
Shape	3
Activated	08/25/09
Deactivated	

Condition
Fire extends down Dam Canyon into Section 30 "east side of Flat Top Mtn NE peak"

Actions
Utilize heavy helicopter to drop water and knock heat out of fire in Dam Canyon, assess effectiveness and ability to utilize 2 Type 1 crews to follow up water drops and suppress fire in Dam Canyon

Resources
1 Type 1 helicopter, 2 Type 1 crews, 1 Type 4 IC, 1Type 3 helicopter with cargo let-down for support of crews and recon

Management Action Point 4

NAME	VALUE
Incident Name	Mill Flat
Cost	$400,000
Shape	4
Activated	08/25/09
Deactivated	

Condition

Fire reaches center of section 30 in Dam Canyon and/or enters Section 19 in Straight Canyon

Actions
Order Type 3 team, 2 Type 1 crews, 2 Type 2 crews, 1 Task Force Type 4-6 engines, 2 type 2 water tenders, 1 Type 1 helicopter, 1 Type 3 helicopter, and supplies for 10,000' hose lay operation. Utilize crews to prep New Harnony Fuel Break amd Commanche trail, including hoselay for support along break. Burnout from prepped fuel break if fire reaches wilderness boundary.

Resources
Type 3 Overhead Team, 2 type 1 crews, 2 Type 2 crews, 1 Task Force Type 4-6 engines, 2 Type 2 water tenders, 1 Type 1 helicopter, 1 type 3 helicopter, 1 helibase manager, 1 water handling specialist.

Management Action Point 5

NAME	VALUE
Incident Name	Mill Flat
Cost	$30,000
Shape	5
Activated	08/25/09
Deactivated	

Condition
Fire threatens to actively move down into Straight or Dam Canyon off of top

Actions
Utilize heavy helicopter to suppress fire on north end to prevent spread down into Straight or Dam Canyon

Resources
1 Type 1 helicopter, 1 Type 4 IC, recon flights in Type 3 helicopter

Management Action Point 7

NAME	VALUE
Incident Name	Mill Flat
Cost	$600,000
Shape	7

Activated 08/25/09

Deactivated

Condition
Fire establishes in Straight Canyon or Dam Canyon.

Actions

Indirect/direct attack combination:

Establish control lines from left flank of fire along Summit Trail down towards Comanche Trail to north, utilize aircraft with water and retardent between natural fuel breaks in the open areas north of the Wilderness boundary working around to east and Comanche Trail area to the New Harmony Fuel Breaks. Use Type 1 Crews to hotspot and follow-up aircraft and to cut line where neccessary. Back-up plan would be improving and burning out Comanche Trail down to New Harmony Fuel Break. Follow through MAP 4 and establish hoselay and resources for defensive burnout of New Harmony Fuel Break if control actions are neccesary in the easterly direction to check fire spread . Burnout control lines if fire crosses wilderness boundary to the east. Necessary administrative allowances to facilitate construction is use of chainsaws to construct control lines, safety zones, escape routes and helispots and use of helicopters to support crews inside wilderness area. Total line to be built approximately 6 miles, expected organization Type 3 IMT with air support and line spike 4 hotshot crews.

Direct attack:

Establish anchor point at base of fire and work around flank to area of chief concern first. This option less likely due to steep topography and downhill line construction. Assess situation as need arises, use risk management process as a guide to decision.

Resources
Type 3 IMT, 1 Air-attack w/platform & relief, 1 Type 1 helicopter, 1 Type 3 helicopter (for recon, medivac, aerial ignition, and support), 4 Type 1 crews, 2 DIVS, 1 HEB2, 2 helitack crews. Overall expectation 2-3 days to establish control lines after all resources in place. (4 Type 1 crews x 4-5 ch/hr line production x 12 hour shifts).

Rationale

Content

Decision updates objectives to include keeping fire from spreading outside Wilderness Boundary on the northeast side toward New Harmony and establish management action points in this regard. Fire has reached 970 acres as of 8/23/2009 and remain actively spreading on top out of canyon, desire is to not allow fire to become established within Dam or Straight Canyon and potentially threaten Wilderness Boundary above New Harmony.

Appendix A

Appendix B: Letter of Delegation

Forest Service | **Intermountain Region** | **324 25th Street Ogden, UT 84401**

File Code: 6730/5190/5100-1 **Date:** September 11, 2009
Route To: (5140)

Subject: Mill Flat Fire Review

To: Becki Heath, Forest Supervisor, Okanogan-Wenatchee National Forest

This letter formalizes your appointment as Team Leader of the Mill Flat Wildland Fire Review. We expect your report to reflect a comprehensive review and analysis of the decision to manage the fire initially, the management of this fire up through transition with the Type 1 Incident Management team on August 30, 2009, and the lessons that can be learned from these decisions and actions. As this fire was an early test of new flexibility in the Implementation of Federal Fire Policy where distinctions between wildland fire use and wildland fire suppression objectives have been eliminated, you may expect heightened interest from the Forest Service Washington Office. To support specific inquiry into Federal Fire Policy implications, we have assigned a team member to specifically address policy implications and lessons learned to your team.

There is guidance for a review such as this available at the Wildland Fire Lessons Learned Center at http://www.wildfirelessons.net/documents/FLA_Guide_62009.pdf. This review is likely to be similar to a Facilitated Learning Analysis (FLA) except your team will be composed of external specialists. The focus should capture the lessons learned to provide a learning opportunity to the land management/fire management community at large. We encourage you to use a format that borrows from the FLA as described in the above mentioned guide. The structure of your report should maximize the learning opportunities afforded by this unique incident. Your report should conclude with recommended actions that will enhance the safety and the performance reliability of our organization. It is our expectation that you use the After Action Review protocol of focusing *not on the who, but on the what*. The managers and firefighters involved in this incident were among our best and brightest and they are in a unique position to help the Forest Service learn in order to better manage future incidents. Your report should enable the reader to understand what happened, why and when critical decisions were made, and what can be learned from these firefighters and managers to help us manage future incidents.

As Team Leader, you have full authority of my office to execute and complete this review. Your team will consist of members with the following skills and affiliations: fire operations specialist,

fire behavior/long term fire analyst, writer-editor, fire management and policy specialist, and a representative from the Utah Department of Natural Resources.

Keep the cost of this review as low as practical. You may authorize travel, overtime, and additional expertise as needed to complete your draft report within 45 business days of your inbriefing. The review will commence on September 28, 2009, at 1600 with a meeting in Cedar City, Utah, specific location will be made prior to your travel.

It is my expectation that you contact me personally and immediately if you uncover acts you believe constitute a reckless and willful disregard for human safety. Otherwise, we respect that the information you collect from individual interviews may remain anonymous to protect the integrity of the report. Your authority includes, but is not limited to:

- Controlling, organizing, managing, and directing the review.
- Controlling and managing the confidentiality of the process.
- Authorizing and requesting additional personnel, including technical specialists, to support your team and releasing them upon completion of assigned duties.
- Authorizing and coordinating the expenditure of appropriated funds.
- Coordinating all media releases regarding the review in conjunction with the Regional Director of Strategic Communications.
- Coordinating local briefings and local citizen participation in the review process.

A draft copy of your report is due in my office on November 13, 2009, 45 days from the start of the review in Cedar City on September 28, 2009. An extension may be granted based on valid justification. The delivery date for the final report will be negotiated at that time based on comments on the draft.

Sue Stewart, Deputy for Fire, Aviation, and Fire Management, at 801-721-5581 is your liaison to my office and can answer questions on the process of this review. All travel, equipment, and salary costs related to this investigation should be charged to P4E5GV with an override code of 0407.

Thank you for your leadership on this important review. We will look forward to your report.

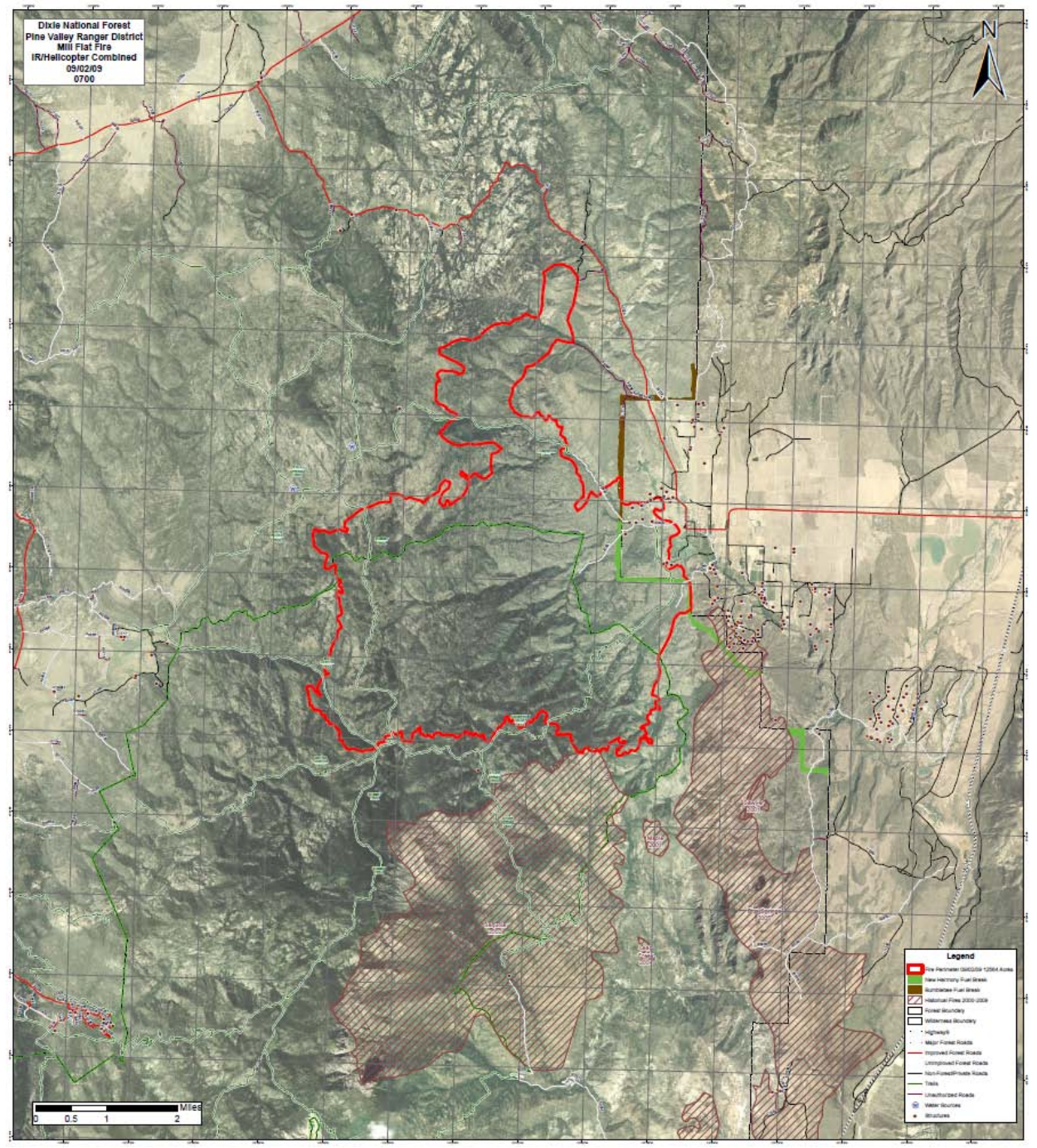
/s/ Jerry Perez (for)
HARV FORSGREN

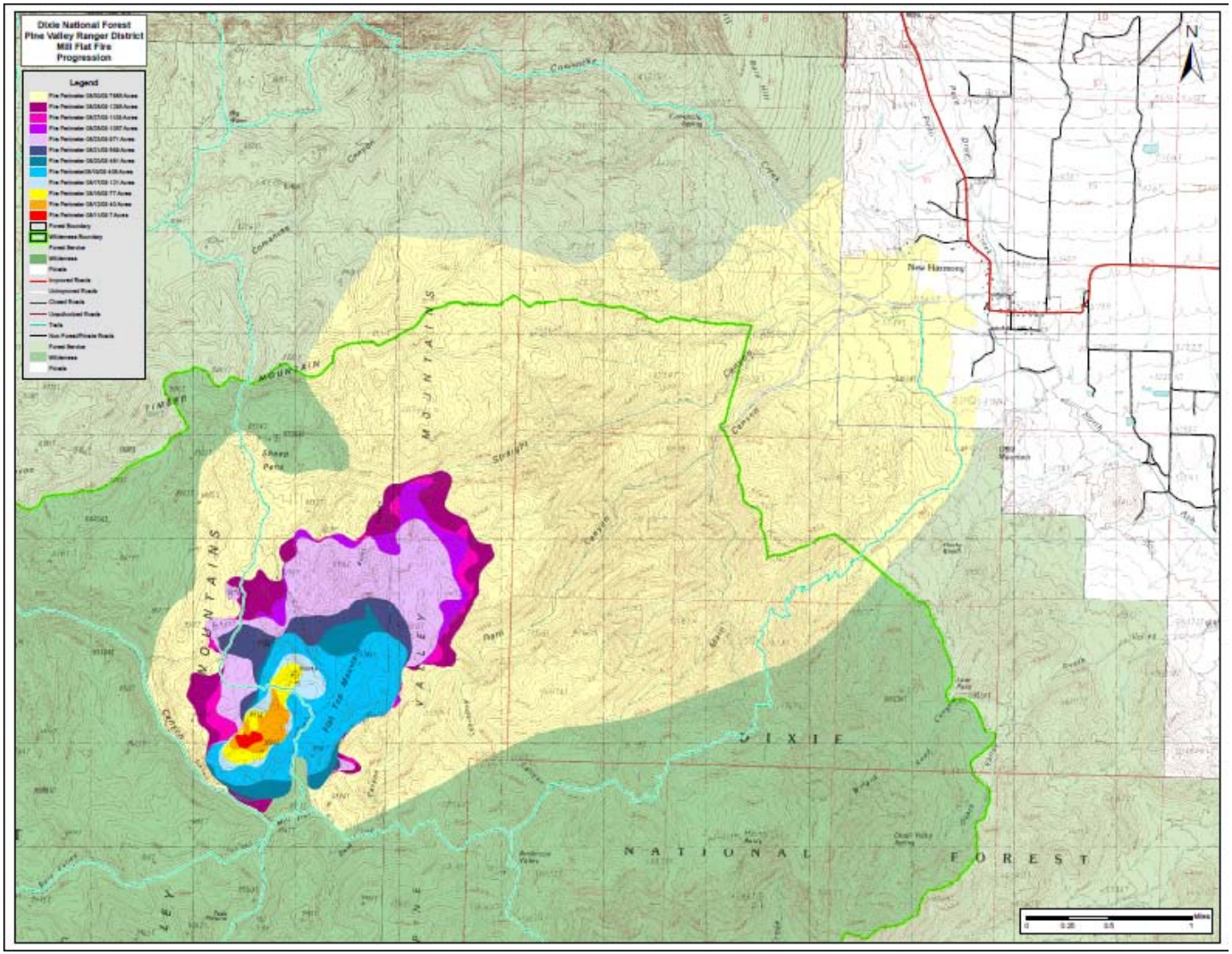
Regional Forester, R-4

cc: Rob Macwhorter
Susan A Stewart
Kevin P Greenhalgh
Steve Holdsambeck
Amanda McAdams
Elizabeth W Lund

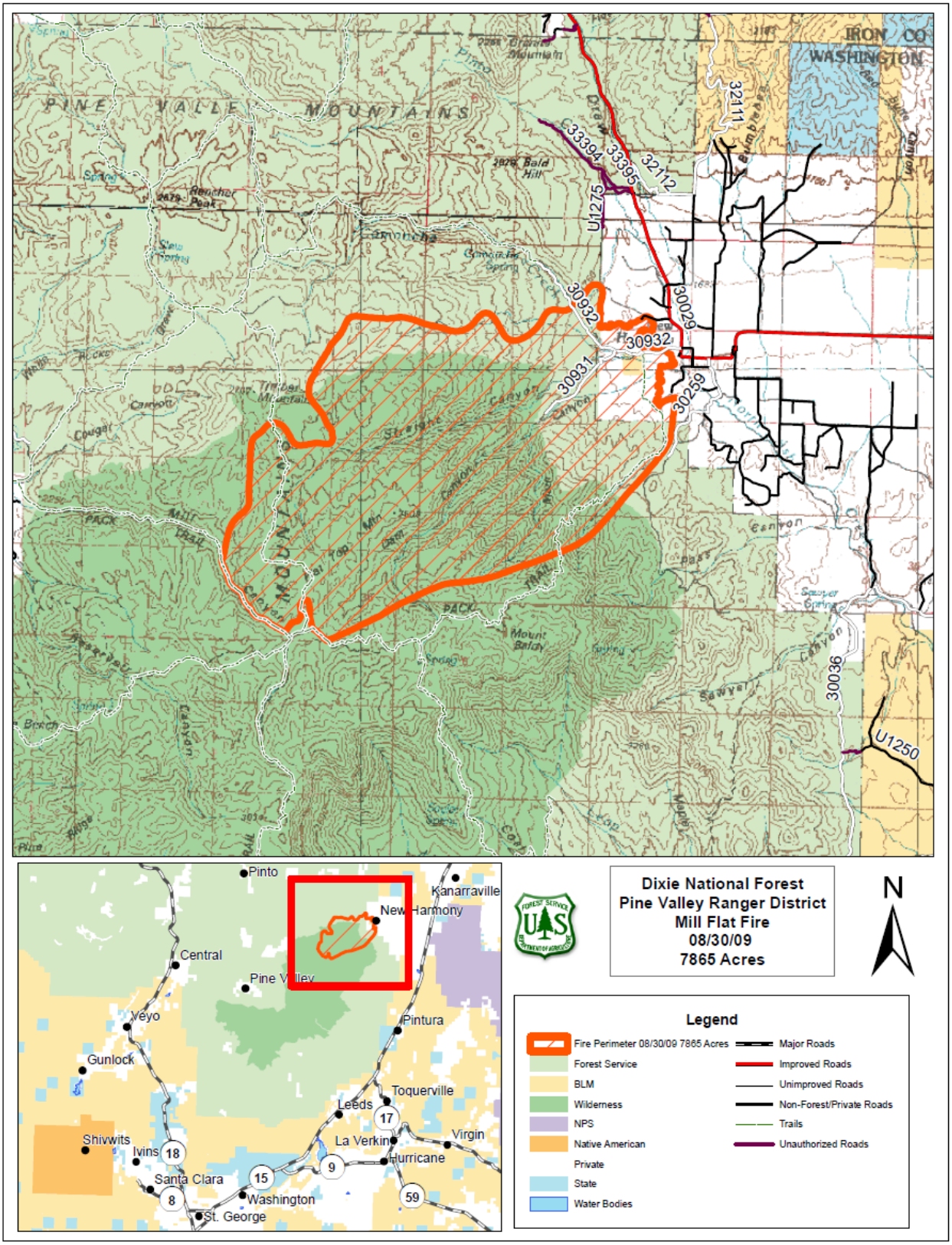
Appendix B

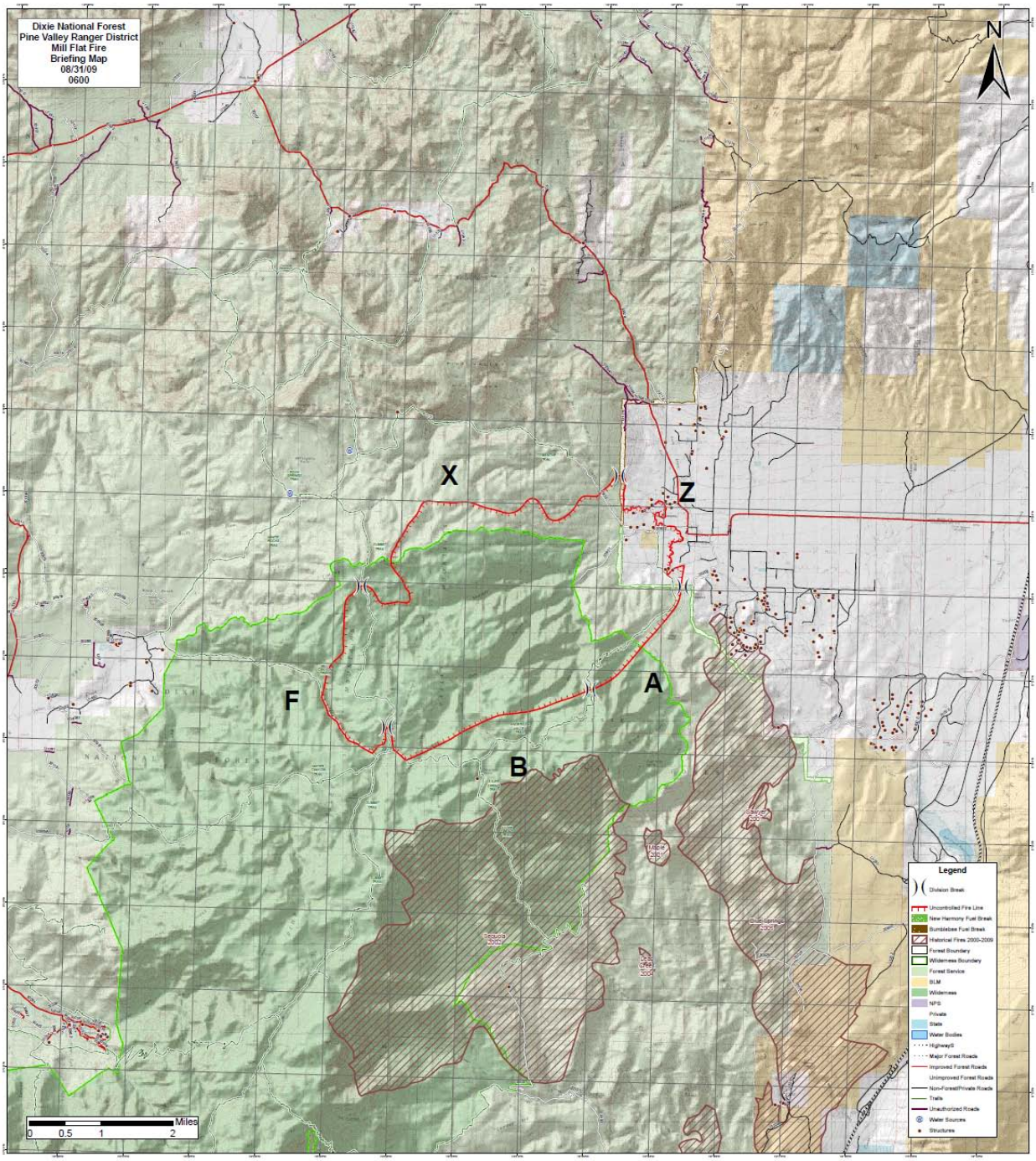
Appendix C: Maps




Dixie National Forest
Pine Valley Ranger District
Mill Flat Fire
Progression
Legend
N
New Harmony
TIMBER MOUNTAIN
PINE VALLEY MOUNTAINS
DIXIE NATIONAL FOREST

Appendix C


PINE VALLEY MOUNTAINS
IRON CO
WASHINGTON
32111
3394
3395
32112
U1275
30932
30029
30931
30259
30036
U1250
Pinto
Kanarraville
New Harmony
Central
Pine Valley
Veyo
Pintura
Gunlock
Toquerville
Leeds
17
Shivwits
Ivins
18
La Verkin
Virgin
Hurricane
9
Santa Clara
15
8
Washington
59
St. George
Dixie National Forest
Pine Valley Ranger District
Mill Flat Fire
08/30/09
7865 Acres
N
Legend
Fire Perimeter 08/30/09 7865 Acres
Forest Service
BLM
Wilderness
NPS
Native American
Private
State
Water Bodies
Major Roads
Improved Roads
Unimproved Roads
Non-Forest/Private Roads
Trails
Unauthorized Roads


Dixie National Forest
Pine Valley Ranger District
Mill Flat Fire
Briefing Map
08/31/09
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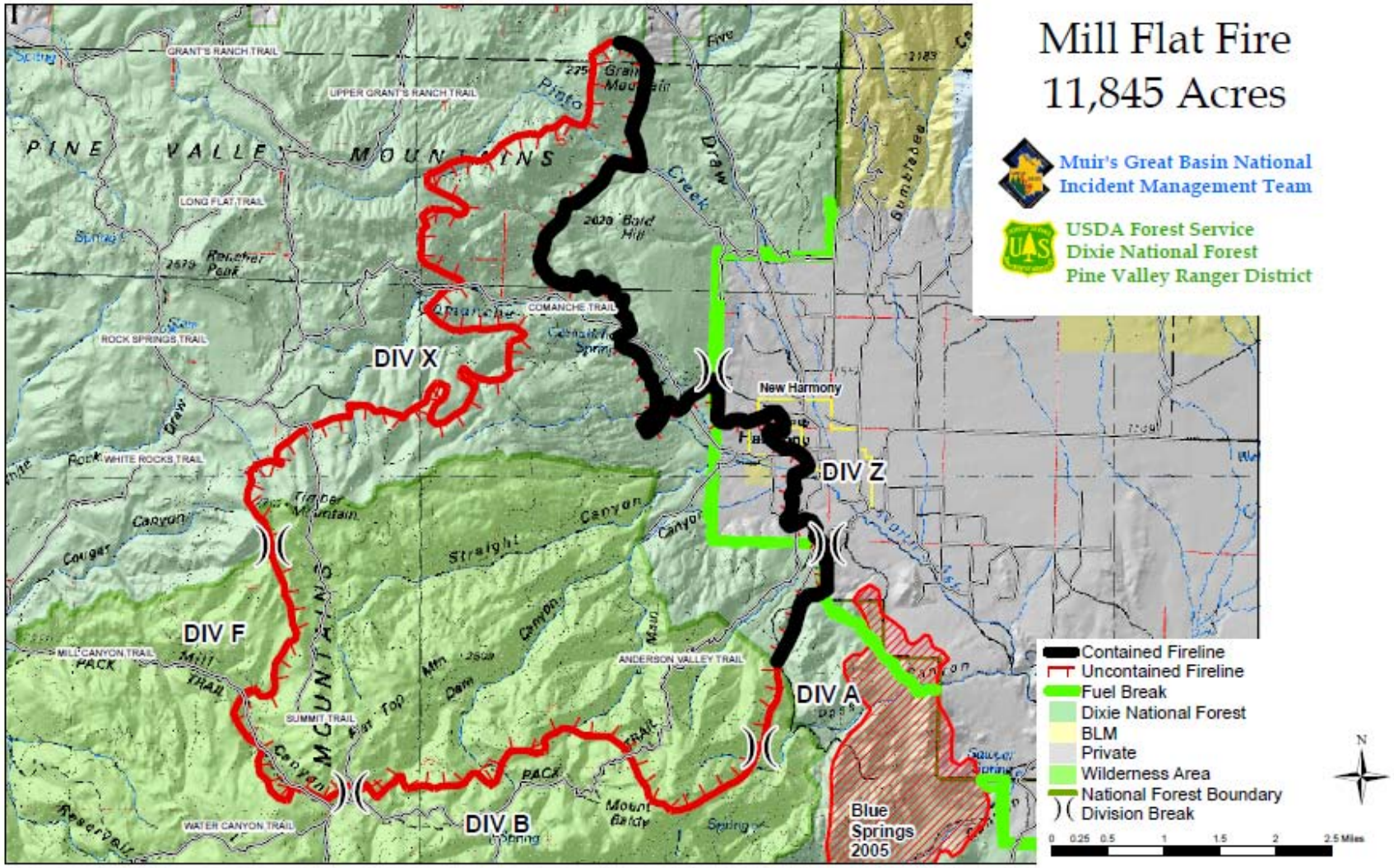
X
Z
F
A
B
Legend
Miles
0 0.5 1 2

Appendix C


Mill Flat Fire
11,845 Acres
Muir's Great Basin National
Incident Management Team
USDA Forest Service
Dixie National Forest
Pine Valley Ranger District
DIV X
DIV Z
DIV F
DIV A
DIV B
New Harmony
Blue Springs 2005
PINE VALLEY MOUNTAINS
GRANT'S RANCH TRAIL
UPPER GRANT'S RANCH TRAIL
LONG FLAT TRAIL
ROCK SPRINGS TRAIL
COMANCHE TRAIL
WHITE ROCKS TRAIL
MILL CANYON TRAIL
SUMMIT TRAIL
WATER CANYON TRAIL
ANDERSON VALLEY TRAIL
Contained Fireline
Uncontained Fireline
Fuel Break
Dixie National Forest
BLM
Private
Wilderness Area
National Forest Boundary
Division Break
0 0.25 0.5 1 1.5 2 2.5 Miles
N

Appendix C

Appendix D: Chronology

The Mill Flat Fire started July 25, 2009 by lightning in the Pine Valley Wilderness on the Dixie National Forest. The initial size up of the fire was conducted on July 26, 2009 due to inaccessibility and weather conditions on July 25, 2009. The fire was in rugged terrain with limited access and few safety zones for firefighters. The fire was managed by the local district in a Type 4 Incident Management structure. It was decided on July 26, 2009 to manage the fire including objectives to achieve resource benefit as defined in the Land Management Plan (LMP)- reducing fuel accumulation and allow for aspen to be brought back into the ecosystem. The fire was monitored by helicopter and showed minimal growth and low fire activity from July 25, 2009-August 10, 2009. The chronology identifies acreage by date, as provided by the final progression map (see Appendix C for the progression map).

Picture taken July 26, 2009 July 25, 2009 .5acres

On August 11, 2009 smoke was visible in the community of New Harmony and from Cedar City Utah (3-25 miles away). The fire grew to seven acres, showing limited torching and short range spotting with one to two foot flame lengths on the ground. An initial FSPro analysis (a computer program that calculates the probability of fire spread from a current fire perimeter for a specific time period) was requested to show the probability and direction of spread and potential size of the fire. The analysis performed by a fire behavior specialist was completed on August 14, 2009.

Increased fire activity was observed on August 15, 2009 and smoke was visible from numerous communities. A helicopter flight determined the fire had grown to 77 acres.

Picture taken August 15, 2009 August 15, 2009 77acres

By August 17, 2009 the fire had grown to 121 acres. Fire was creeping along the ground and isolated torching was observed by fire managers when they flew over the fire. The fire was moving north and staying on the ridge tops.

The fire continued to grow to 406 acres to the northeast by August 19, 2009 with active surface fire and isolated torching, resulting in closure of the Summit Trail from Mill Flat north. A new FSPro run was requested, but it was determined that the original analysis was still valid and sufficient with the weather forecast for the upcoming weekend. Another run on the program was not completed. The fire activity continued to create columns of smoke visible from surrounding communities, generating interest from residents.

Picture taken August 19, 2009 August 19, 2009 406 acres

The fire continued to be monitored through August 20, 2009 with the fire growing to 481 acres, moving north and creeping east down the ridge above Dam canyon. Fire managers flew the fire to assess fire spread, fire behavior, and potential management actions.

Picture taken August 20, 2009 August 20, 2009 481 acres

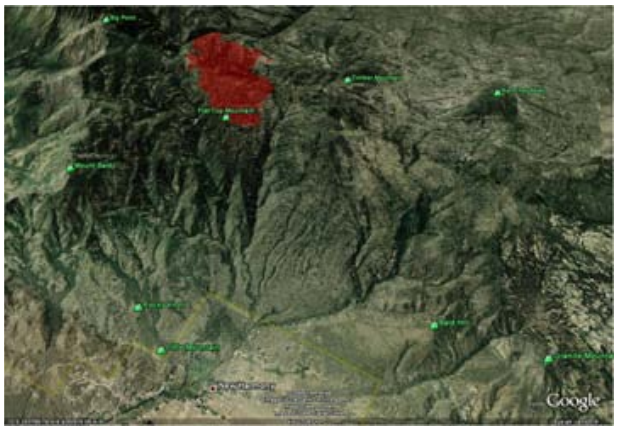
The fire was assessed on the ground on August 21, 2009 at 589 acres. The fire was burning in dead fuels within aspen and mixed conifer stands and holding when reaching meadows and mountain mahogany stands. Onsite weather observations and weather data from the Enterprise Remote Automated Weather Station (RAWS) were used to determine local weather affecting the fire.

Picture taken August 21, 2009 Picture Taken August 21, 2009

August 21, 2009 589 acres

Appendix D

By August 23, 2009 the fire had grown steadily to 971 acres. A Type 2 initial attack fire crew was assigned clear the New Harmony fuel break at the forest boundary as part of contingency planning. The New Harmony fuel break was constructed in 2002 and was completed in 2004 with pile burning. Oak brush had re-grown in most of the fuel break, and original NEPA and contracts had excluded treatments in the drainage bottoms, leaving 600 foot strips of untreated fuels through the fuel break. The crew was directed to open up the strips that had been untouched during previous treatments. The crew was unable to complete the fuels reduction because they were re-assigned on August 24, 2009 to another fire that was deemed a higher priority.



Picture taken August 23, 2009 August 23, 2009 971 acres

A Type 1 helicopter (a large helicopter that can deliver large volumes of water on a fire) and a fire use module were ordered on August 25, 2009 to the fire. The fire was flown by helicopter and a new WFDSS decision including finalized management action points and a revised planning area boundary were published. Management action points are “trigger” points on the ground where specific actions may be needed. Management action points had been in draft form since August 19, 2009.

Picture taken August 25, 2009 August 25, 2009 1,057 acres

On August 26, 2009 forest staff conducted a town hall meeting in New Harmony to inform the community of the fire situation, management action points, and to field questions and listen to concerns. Additional hand crews and engines were assigned to work on the fuel break west of

New Harmony. Another FSPro run was requested, but the analyst was not able to complete the necessary calibrations due to a lack of current data.

On August 27, 2009 fire activity had increased, burning in mountain mahogany fuels near Straight and Dam Canyons and had reached the management action point in Straight Canyon (see Appendix A). The Type 1 helicopter was assigned to suppress/slow the fire in Straight and Dam canyons.

Picture taken August 27, 2009 August 27, 2009 1,109 acres

The Type 1 helicopter was used for the entire operational period on August 28, 2009 to keep fire that was on the slopes of Dam and Straight Canyons from becoming established in the bottoms of the canyons.

Picture taken August 28, 2009 August 28, 2009 1,295 acres

Dry fuels and low relative humidity caused the fire to grow to 1,401 acres on August 29, 2009. By mid-day, fire had established itself at the top of Dam and Straight Canyons and was burning in mountain mahogany. Lack of visibility decreased the effectiveness of the Type 1 helicopter (due to smoke). After a recon flight at 1415, the decision was made to order a Type 3 IMT and additional resources though they would not assume command of the fire until the next morning.

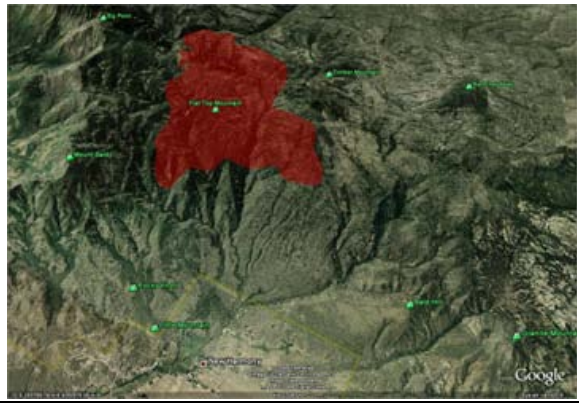
Appendix D

Extreme fire behavior led to rapid fire movement downhill towards New Harmony. The Incident Commander ordered all resources to attempt to complete the fuel break and to do preparation work around the structures, and evacuate the area. After completing a complexity analysis, the Incident Commander ordered a Type 1 IMT at 16:35. Air tankers called to the scene were unable to operate in front of the fire at the fuel break due to safety concerns with smoke, high winds, and turbulence. A burn out operation began around 1815, firing off of the fuel break. As extreme fire behavior on the main fire front approached the fuel break, it became unsafe for the firing operation to continue and all of the personnel and equipment were pulled out by 1935. The fire front and spot fires breached the fuel break by 2026 and fire actively burned in the town of New Harmony. By 2100 it was confirmed that three residences (one primary and two secondary) were destroyed, three additional residences were significantly damaged, and seven other structures including outbuildings and corrals were burned. Twenty additional buildings were threatened. At 2217 a red flag warning was issued for fire weather conditions. The fire burned throughout the night and no additional structures were lost. By 2245 the fire activity had decreased in the town.

Picture taken August 29, 2009

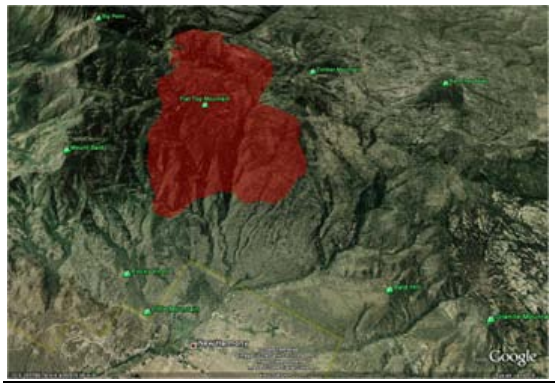
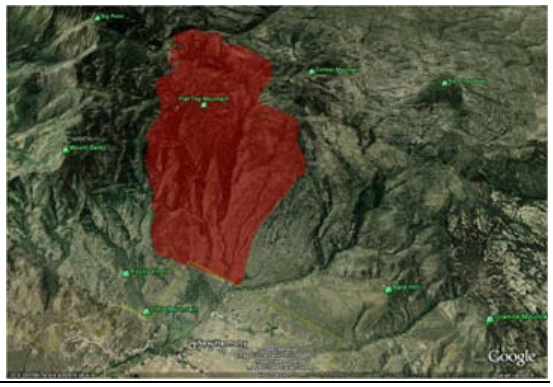
Picture taken August 29, 2009

August 29, 2009 at 1400 1,401 acres



August 29,2009 at 1630 3,277 acres

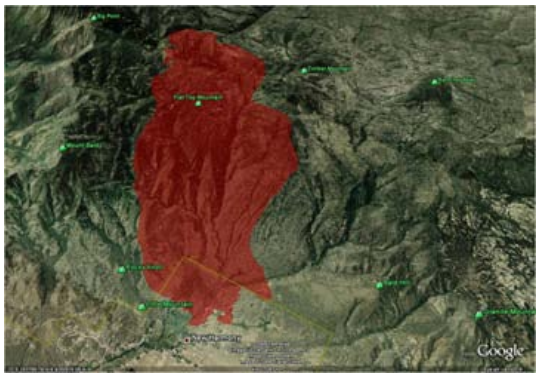
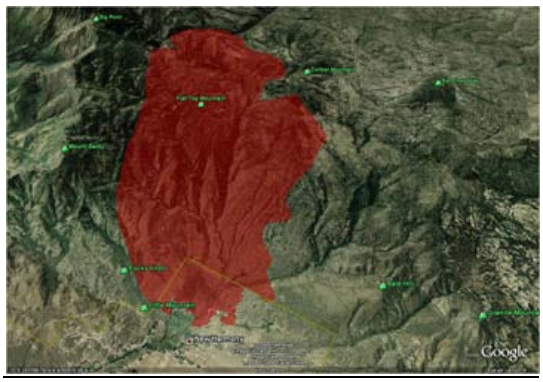
Appendix D

August 29, 2009 at 1650 4,184 acres August 29, 2009 at 1900 5,253 acres

On August 30, 2009 fire management transitioned to a Type 3 team at 0745. At 0830 the fire perimeter had grown to 6,205 acres. By the evening of August 30, 2009 the fire had grown to 7,641 acres. Fire activity continued to threaten homes with torching, running and aggressive surface spread. A town meeting was held and residents expressed their concerns. The fire was fought through the night and no additional structures were lost.


Picture taken August 30, 2009 Picture taken August 30, 2009

August 30, 2009 at 0800 6,205acres August 30, 2009 at 1900 7,641acres

On August 31, 2009 at 0600, fire management transitioned to a Type 1 Incident Management Team

Appendix D

Appendix E: Fire Behavior

Environmental Setting:

Fire Behavior Summary

The Mill Flat Fire was discovered on July 25, 2009 and during the first 18 days the fire only grew to 7 acres. The calculated rate of spread was .12 chains per hour averaged over a 6 hour burn period for each day. Over the next 17 days, the fire grew an average of 2.3 chains per hour (about 151 feet per hour) with the greatest increase being 5.3 chains per hour (350 feet per hour) for one day. The size of the fire at 1400 on July 29, 2009 (30 + days later) was 1,401 acres. On August 29, 2009, between 1300 and 2100 the fire's growth peaked at 85 chains per hour (more than 1 mile per hour) and averaged 31 chains per hour (about .50 miles per hour) during this time. The resulting single day growth was 3,852 acres for a total of 5,253 acres; surprising many fire personnel that did not expect such extreme fire behavior.

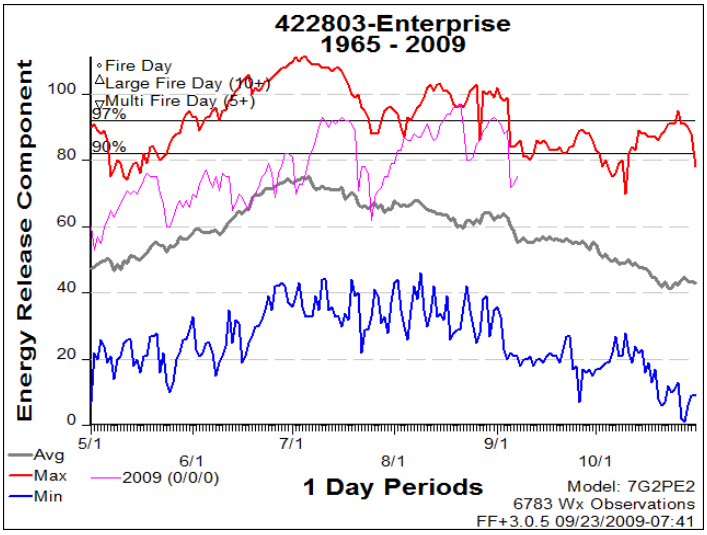


Figure 1

The fire danger conditions were calculated using the Fire Family Plus program (Bradshaw & McCormick, 2000) from the Enterprise weather station. Fire Family Plus is a fire climatology and occurrence program that allows the user to summarize and analyze weather observations, associating weather with local fire occurrence data, and compute fire danger indices based on the National Fire Danger Rating System (NFDRS) (Deeming, 1977). Figure 1 shows the Energy Release Component (ERC) for the Enterprise weather station (figure 1 was used for the review team's fire behavior models (see Appendix K), not for the development of pocket cards). When the fire started, the ERC was just below average for that time of year. Over the next several weeks the ERC continued to increase until it reached near record highs and was well above the 90th percentile on August 29, 2009 (see Appendix F).

The Color Country high elevation Fuel Model G pocket card that is posted on the National Wildfire Coordinating Group (NWCG) website *(see Appendix G) identifies local thresholds for Energy Release Component levels for areas above 7,000 ft. It states "a combination of any of these factors can greatly increase fire behavior:* 20' wind speeds over 9 mph, relative humidity below 12 percent, temperatures over 80 degrees, Haines Index of 5 or 6". These conditions were all predicted and occurred on August 29, 2009 (see Appendix H). Color Country fire managers used the Color Country Mountains pocket card that was updated May 15, 2009 (see Appendix G).

The Fire Environment

Fuel Type

The fuels where the fire started and burned for the first 35 days were timber stands of mixed conifer with heavy dead and down fuel loadings (see Figure 2). The surface fuel can best be characterized as a Fire Behavior Fuel Model 10 (Anderson, 1982). Typically in this fuel model, surface fuels burn with greater fire intensity than other timber litter models. Fuel model 10 has greater quantities of dead and down fuels of 3-inch or larger limbwood resulting from over maturity that creates a large load of dead material on the forest floor. The fire behavior in this fuel model produces greater intensities (flame lengths) but less rapid rates of spread.

Figure 2

Figure 3

On August 29, 2009 the fire had moved from a timber fuel model into a brush fuel model. Much of the area where the fire burned on August 29, 2009 was mature stands of curlleaf mountain mahogany (*Cercocarpus ledifolius)* with pockets of Pinyon and Juniper. The surface fuels can best be characterized as a Fire Behavior Fuel Model SH7 Very High Load, Dry Climate Shrub (Scott & Burgan, 2005). The primary carrier of fire in all SH fuel models are live and dead shrub twigs and foliage in combination with dead and down shrub litter. Specifically for Fuel Model SH7, the primary carrier of fire is woody shrubs and shrub litter with very heavy shrub load, to a height of four to six feet. The spread rate is high; the flame length very high. Spread rates for this fuel can be as high as 200 chains per hour (about 2.5 mph) and flame lengths can be as much as 25 feet.

Fuel Moisture Live fuel moistures and 1,000 hour fuel moistures were sampled on August 28, 2009 the day before the fire made its major fire run. Samples were taken both on top near the fire and down below in the valley. The results of the samples are in Figure 4. The sampling process was not complete before the fire made its run, but the National Fire Danger Rating System readings at the Enterprise weather station was showing similar measurements. Although no research has been done to document the

Sample taken on top near fire	
Fuel Type	Fuel Moisture Averages
Mtn. Mahogany	76.55
Manzanita	103.53
1000 Hour	8.76
Sample taken below fire	
Fuel Type	Fuel Moisture Averages
Mtn. Mahogany	64.39
Manzanita	90.95
1000 Hour	7.25

Figure 4

critical live fuel moisture levels for curlleaf mountain mahogany, that species burned briskly with live fuel moistures between 64 and 77% on August 29th. Fire behavior prediction models describe the lowest threshold for live fuels at 60%, "very low." The next higher category is 90 % "low," which still produces very high rates of spread and intensities. As seen on Figure 4, both locations were well below the 90 % level and approaching the 60 % level.

Topography

The fire started at 8,900ft elevation and the terrain could best be described as rolling to flat with little elevation change. The fire burned in an area known as Flat Top Mountain. By August 29, 2009 the fire had burned most of Flat Top Mountain and the topography was changing to steeper down slopes that enter prominent canyons, one to the north and one to the south of the fire. Both

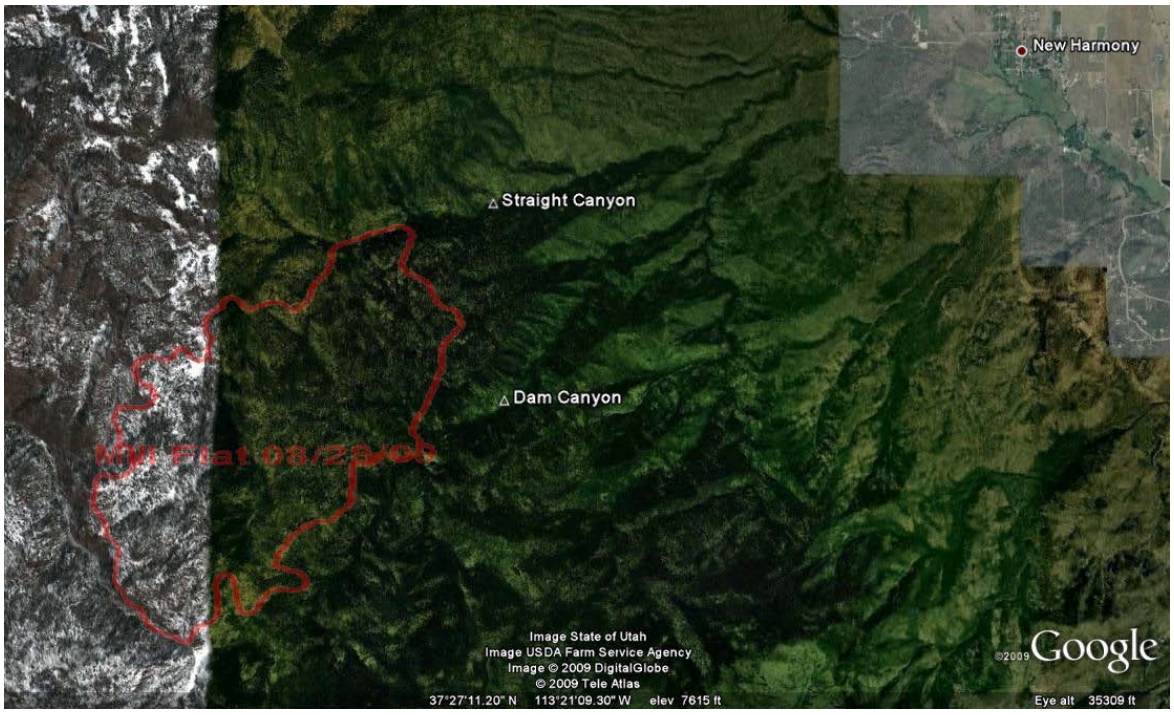


Figure 5

canyons flow to the east and connect just above New Harmony and are fairly linear (hence the name "Straight Canyon"). These canyons were very important features in terms of fire behavior because they would ultimately funnel southwest winds into New Harmony (see Figure 5).

Weather

The Enterprise Remote Automated Weather Station accurately represented the weather affecting the fire. Much of the weather data in this report was taken directly from the Enterprise Weather Station. The three main weather factors affecting the fire behavior were wind, relative humidity (RH) and the Haines index. The Haines index measures atmospheric stability (Haines, 1988) on a scale of 1-6, with six being the most unstable.

Figure 6 displays the actual weather recorded at the Enterprise weather station on August 29th .

Enterprise							
: LST	mph	Deg	Deg F	Deg F	%	Deg	mph
: Date/Time	Wind	Wind	Av Air	Fuel	Rel	Dir	Mx Gust
:YYMMDDhhmm	Speed	Direc	Temp	Temp	Humidt	MxGus	t Speed
908291300	10	285	95	109	8	229	28
908291400	14	258	95	109	8	243	33
908291500	16	228	96	106	9	208	32
908291600	14	204	96	106	8	256	27
908291700	15	215	93	99	9	198	33
908291800	12	216	90	93	9	209	28
908291900	11	216	86	82	10	213	23
908292000	6	206	79	75	13	208	16
908292100	7	222	74	69	15	200	10

Figure 6

The spot weather forecast issued on the afternoon of August 28, 2009 predicted for the afternoon of August 29, 2009 temperatures of 82-84 degrees , winds out of the southwest 5 – 10 mph increasing to 10 to 15 mph, relative humidity of 13-15 percent, and a Haines Index of 6 high (see Appendix H). The actual weather readings for relative humidity were lower and the winds were slightly higher than forecasted.

The review team analyzed the winds using WindNinja, a new computer program designed for wildfire application (Forthofer, 2009). It computes spatially varying wind fields to simulate the affects of terrain on wind flow to determine surface wind patterns. Figure 7 shows the results of an analysis for the winds on August 29, 2009. It shows the topography didn't have a large effect on the ground level wind and a southwest wind would channel down the two canyons.

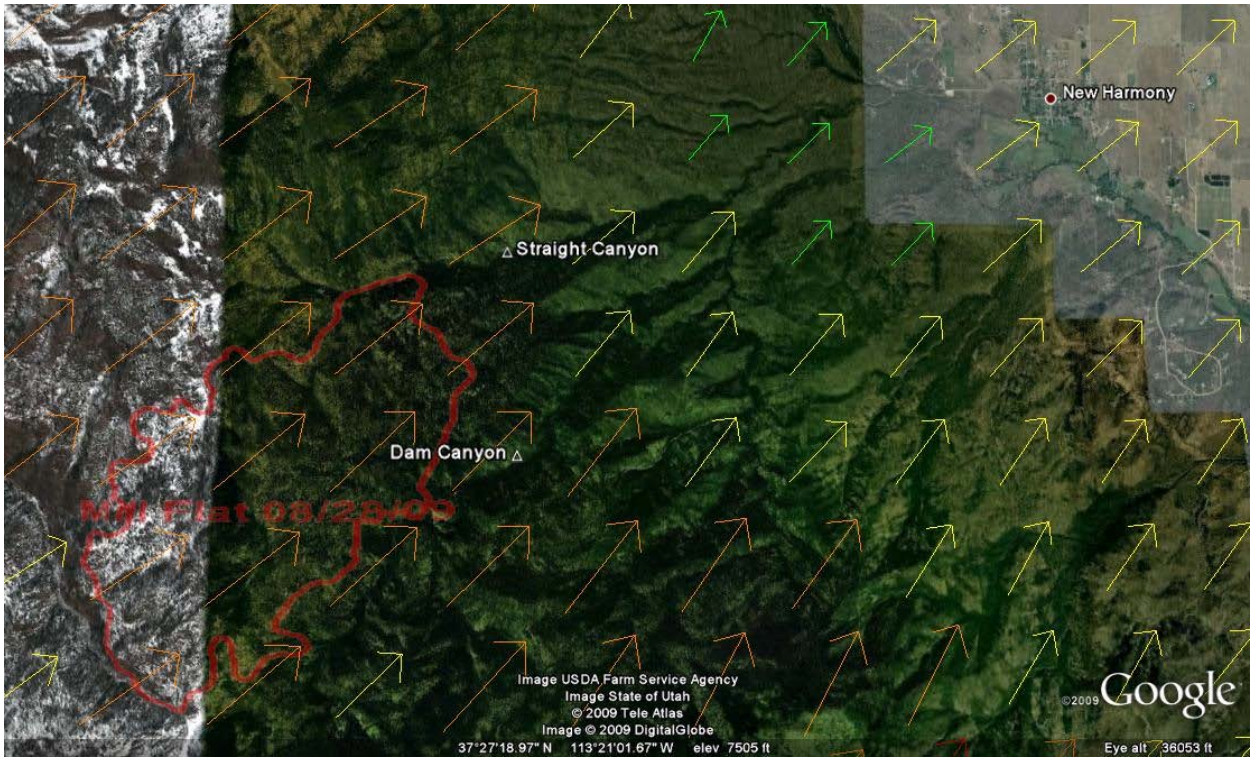


Figure 7

The three main contributing factors were relative humidity, atmospheric stability and wind. Whenever relative humidity drops below 10 %, extreme fire behavior can be expected. A Haines Index of 6 high indicates probability for a plume dominated fire. The winds were not strong enough to develop a classic wind driven fire, although sufficient enough to contribute to extreme fire behavior. The midlevel winds moved the fire down the hill without taking the energy produced by the fire away.

Appendix E

Appendix F: Energy Release Components (ERC's)

DATE	ERC Value For Date
7/26/09	71 (55th percentile)
8/4/09	90 (92nd percentile)
8/11/09	92 (94th percentile)
8/12/09	90 (92nd percentile)
8/15/09	94 (95th percentile)
8/17/09	(96th percentile)
8/19/09	97 (96th percentile)
8/20/09	97 (96th percentile)
8/23/09	82 (81st percentile)
8/25/09	83 (81st percentile)
8/27/09	88 (90th percentile)
8/28/09	91 (92nd percentile)
8/30/09	93 (94th percentile)

Appendix G: Pocket Cards

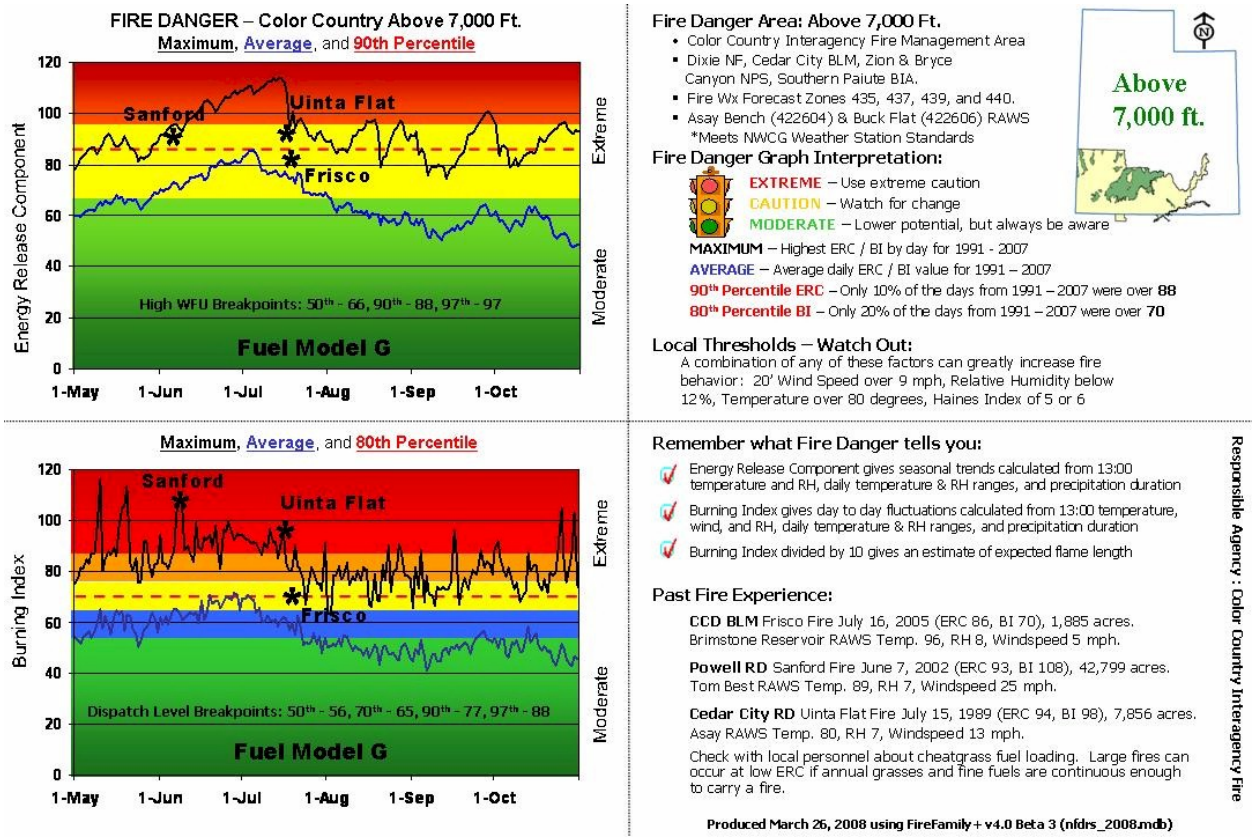
Eastern Great Basin

Color Country Interagency Dispatch Center - high elevation

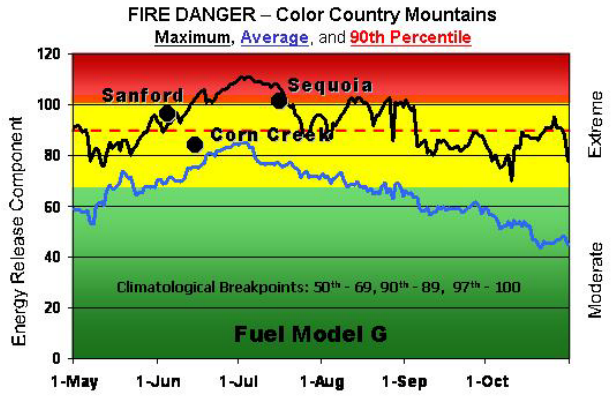
Fuel Model G

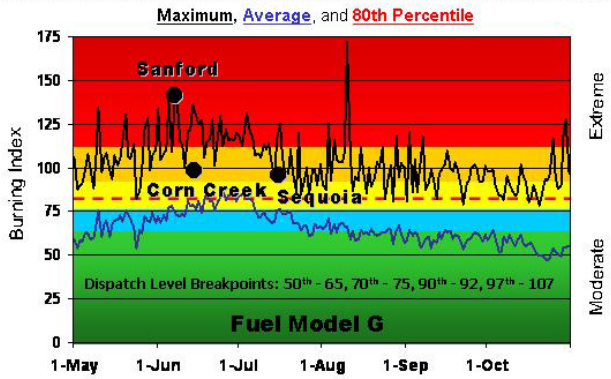
Created by Scott Tobler, Dixie NF

http://fam.nwcg.gov/fam-web/pocketcards/dixie.htm



Eastern Great Basin
Color Country Interagency Dispatch Center- Mountains
Fuel Model G





Fire Danger Area: Color Country Mountains

- Color Country Interagency Fire Management Area
- Dixie NF, Cedar City BLM, Zion & Bryce Canyon NPS
- Fire Wx Forecast Zone UT 437
- Enterprise* (422803), Asay Bench* (422604)
- and Tom Best* (422608) RAWS

*Meets NWCG Weather Station Standards

Fire Danger Graph Interpretation:

EXTREME – Use extreme caution
CAUTION – Watch for change
MODERATE – Lower potential, but always be aware

MAXIMUM – Highest ERC / BI by day for 1989 - 2008
AVERAGE – Average daily ERC / BI value for 1989 – 2008
90th Percentile ERC – Only 10% of the days from 1989 – 2008 were over **89**
80th Percentile BI – Only 20% of the days from 1989 – 2008 were over **82**

Local Thresholds – Watch Out:

A combination of any of these 90th percentile factors can greatly increase fire behavior: 20' Wind Speed over 14 mph, Relative Humidity below 9%, Temperature over 87 degrees, Haines Index of 5 or 6

Remember what Fire Danger tells you:

- Energy Release Component gives seasonal trends calculated from 13:00 temperature and RH, daily temperature & RH ranges, and precipitation duration
- Burning Index gives day to day fluctuations calculated from 13:00 temperature, wind, and RH, daily temperature & RH ranges, and precipitation duration
- Burning Index divided by 10 gives an estimate of expected flame length

Past Fire Experience:

Pine Valley RD Sequoia Fire July 14, 2002 (ERC 101, BI 91), 8,100 acres. Enterprise RAWS Temp. 97, RH 13, Windspeed 12 mph.

Powell RD Sanford Fire (major spread event) June 7, 2002 (ERC 95, BI 135), 42,799 acres. Tom Best RAWS Temp. 89, RH 7, Windspeed 25 mph.

Escalante RD Corn Creek Fire June 15, 2008 (ERC 84, BI 97), 2,269 acres. Buck Flat RAWS Temp. 84, RH 5, Windspeed 6 mph.

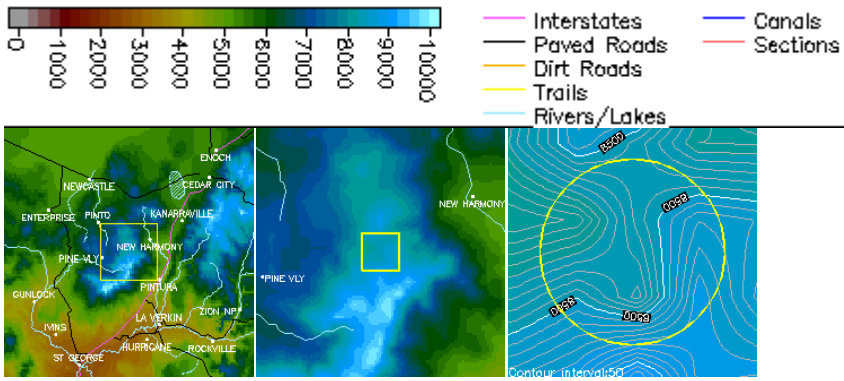
Check with local personnel about cheatgrass fuel loading. Large fires can occur at low ERC if annual grasses and fine fuels are continuous enough to carry a fire.

Produced May 15, 2009 using FireFamily+ v4.0.2 (cc_nfdrs_2009_v2.mdb)

Responsible Agency : Color Country Interagency Fire

Appendix H: Spot Weather Forecasts

Mill Flat (WFU) (Requested: 1348 MDT 8/27/09) **Forecast complete at 1408 MDT 8/27/09** Requested by: CCIFC



Location: Legal: Lat/Lon:37.4382/113.3924 Quad:Grass Valley
Calculated: (37°26'17"N 113°23'32"W) (GRASS VALLEY UT)
Elevation:8200-8836 Drainage:Dam Canyon Aspect:East Size:970 Fuel Type:Timber (Partially Sheltered) **Observations:**

Place Elev Time Wind Temp Wetbulb RH Dewpt Remarks

Requested Parameters

```
XXX LAL
XXX Haines Index
XXX Clearing Index
XXX   Sky/Weather
XXX   Temperature
XXX   Humidity
XXX   Wind - 20 Foot
```

Remarks

```
Please use Lava Point RAWS (at
similar elevation across valley,
wind sensor reads 180 degrees from
true) and/or Enterprise RAWS for
observations.  Fire is in Pine
Valley wilderness.
Particularly interested in winds,
humidity recovery and outlook for
next several days, and Clearing
index.  Call with any
questions.  Thanks.
```

FORECAST:

```
IF CONDITIONS BECOME UNREPRESENTATIVE,
CONTACT THE NATIONAL WEATHER SERVICE.

SPOT FORECAST FOR MILL FLAT
NATIONAL WEATHER SERVICE SALT LAKE CITY UT
208 PM MDT THU AUG 27 2009

.DISCUSSION...HIGH PRESSURE CONTINUES TO BUILD INTO THE REGION
THIS AFTERNOON AND WILL REMAIN IN PLACE THROUGH SATURDAY. THIS
WILL KEEP WEAK TRANSPORT WINDS AND POOR CLEARING INDICES IN PLACE
AT THE BURN SITE TODAY AND FRIDAY.

A RELATIVELY WEAK DISTURBANCE WILL CROSS THE NORTHERN
```

INTERMOUNTAIN REGION SATURDAY INTO SUNDAY. THE BEST CHANCE FOR
ANY PRECIPITATION WITH THIS SYSTEM WILL BE ACROSS THE NORTHERN
HALF OF UTAH. HOWEVER...WINDS ARE EXPECTED TO INCREASE AT THE
BURN SITE SATURDAY AND SUNDAY BRINGING CLEARING INDICES ABOVE
500. HIGH PRESSURE AND WEAK TRANSPORT WINDS ARE EXPECTED TO BUILD
BACK INTO THE AREA EARLY NEXT WEEK.

.REST OF TODAY...
  LAL.................1.
  HAINES INDEX........5 ..MODERATE.
  CLEARING INDEX......390.
  SKY/WEATHER.........MOSTLY SUNNY (20-30 PERCENT CLOUD COVER).
  MAX TEMPERATURE.....82-84.
  MIN HUMIDITY........14-16 PERCENT.
  WINDS - 20-FOOT.....UPSLOPE/UPVALLEY 4 TO 8 MPH.

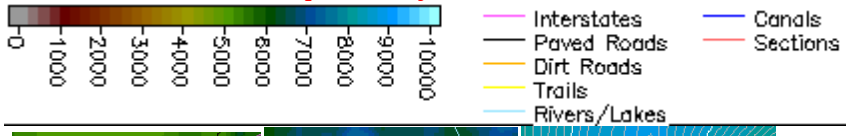
.TONIGHT...
  LAL.................1.
  HAINES INDEX........4 ..LOW.
  SKY/WEATHER.........MOSTLY CLEAR (10-20 PERCENT CLOUD COVER).
  MIN TEMPERATURE.....50-52.
  MAX HUMIDITY........37-39 PERCENT.
  WINDS - 20-FOOT.....UPSLOPE/UPVALLEY 3 TO 6 MPH BECOMING
                      DOWNSLOPE/DOWNVALLEY 2 TO 5 MPH AFTER
                      SUNSET.

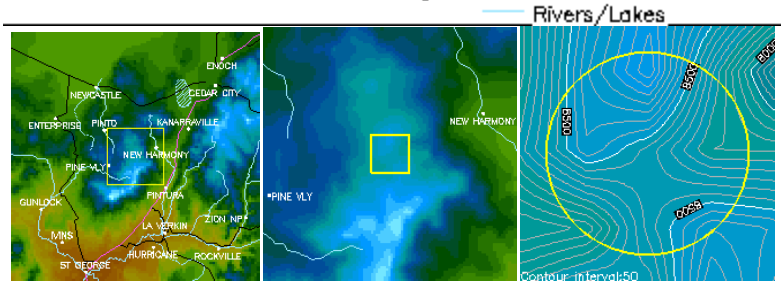
.OUTLOOK FOR FRIDAY...
  LAL.................1.
  HAINES INDEX........6 ..HIGH.
  CLEARING INDEX......310.
  SKY/WEATHER.........MOSTLY SUNNY (10-20 PERCENT CLOUD COVER).
  MAX TEMPERATURE.....82-84.
  MIN HUMIDITY........14-16 PERCENT.
  WINDS - 20-FOOT.....DOWNSLOPE/DOWNVALLEY 2 TO 5 MPH BECOMING
                      UPSLOPE/UPVALLEY 3 TO 6 MPH AFTER 1000.

FORECASTER...KRUSE
REQUESTED BY...LINDA CHAPPELL
REASON FOR REQUEST...WFU

8/28/09

Mill Flat (WILDFIRE) (Requested: 1659 MDT 8/28/09) **Forecast complete at 1751 MDT 8/28/09** Requested by: CCIFC





Location: Legal: Lat/Lon:37.4496/113.3919 Quad:Grass Valley
Calculated: (37°26'58"N 113°23'30"W) (GRASS VALLEY UT)
Elevation:8200-8836 Drainage:Dam Canyon Aspect:East Size:1109 Fuel Type:Timber (Partially Sheltered) **Observations:**

Place	Elev	Time	Wind	Temp	Wetbulb	RH	Dewpt	Remarks
37.4496x113.3919	8490	1600	2-4 G6 SW	80	54	19	34	15%CC
					Calculated:	22	38	
37.4495x113.3947	8400	1630	0-2 SW	81	51	18	33	25%CC
					Calculated:	15	29	

Requested Parameters **Remarks**

```
XXX LAL
XXX Haines Index
XXX Clearing Index
XXX   Sky/Weather
XXX   Temperature
XXX   Humidity
XXX   Wind - 20 Foot
```

FORECAST:

```
IF CONDITIONS BECOME UNREPRESENTATIVE,
CONTACT THE NATIONAL WEATHER SERVICE.

SPOT FORECAST FOR MILL FLAT
NATIONAL WEATHER SERVICE SALT LAKE CITY UT
551 PM MDT FRI AUG 28 2009

.DISCUSSION...WARM TEMPERATURES WILL CONTINUE ACROSS THE AREA
THROUGH THE WEEKEND. THERE WILL BE A SLIGHT CHANCE OF A DRY
THUNDERSTORM NEAR THE FIRE SATURDAY. A PACIFIC WEATHER SYSTEM
WILL CROSS THE PACIFIC NORTHWEST STATES AND THE NORTHERN ROCKIES
SATURDAY THROUGH MONDAY. THIS WILL BRING AN INCREASE IN AFTERNOON
SOUTHWEST WINDS TO THE FIRE SITE STARTING SATURDAY THEN BECOMING
STRONGER SUNDAY AND CONTINUING INTO MONDAY. HUMIDITIES WILL REMAIN
LOW WITH POOR OVERNIGHT RECOVERIES THROUGH THIS TIME RESULTING IN
NEAR CRITICAL FIRE WEATHER CONDITIONS AT THE FIRE SUNDAY AND
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MONDAY. WINDS WILL DIMINISH TUESDAY BUT HUMIDITIES WILL COME UP A
BIT AND THERE WILL BE A SLIGHT CHANCE OF AFTERNOON AND EVENING
THUNDERSTORMS AGAIN TUESDAY WITH A BETTER CHANCE WEDNESDAY.



.TONIGHT...
  LAL.................1.
  HAINES INDEX........5 ..MODERATE.
  SKY/WEATHER.........MOSTLY CLEAR (10-20 PERCENT CLOUD COVER).
  MIN TEMPERATURE.....55-57.
  MAX HUMIDITY........37-39 PERCENT.
  WINDS - 20-FOOT.....SOUTHWEST WINDS 5 MPH.

.SATURDAY...
  LAL.................1 UNTIL NOON...THEN 2.
  HAINES INDEX........6 ..HIGH.
  CLEARING INDEX......1000+.
  SKY/WEATHER.........SUNNY (0-10 PERCENT CLOUD COVER) UNTIL
                      NOON...THEN PARTLY CLOUDY (40-50 PERCENT
                      CLOUD COVER). A SLIGHT CHANCE OF A DRY
                      THUNDERSTORM AFTER NOON.
  MAX TEMPERATURE.....82-84.
  MIN HUMIDITY........14-16 PERCENT.
  WINDS - 20-FOOT.....SOUTHWEST WINDS 5 TO 10 MPH INCREASING TO
                      10 TO 15 MPH IN THE AFTERNOON.

.OUTLOOK FOR SUNDAY...
  LAL.................1.
  HAINES INDEX........5 ..MODERATE.
  CLEARING INDEX......1000+.
  SKY/WEATHER.........MOSTLY SUNNY (5-15 PERCENT CLOUD COVER) THEN
                      BECOMING PARTLY CLOUDY (40-50 PERCENT CLOUD
                      COVER).
  MAX TEMPERATURE.....76-78.
  MIN HUMIDITY........18-20 PERCENT.
  WINDS - 20-FOOT.....BREEZY. SOUTHWEST WINDS 10 TO 15 MPH
                      INCREASING TO 20 TO 25 MPH WITH STRONGER
                      GUSTS IN THE AFTERNOON.



FORECASTER...WILENSKY
REQUESTED BY...GREENHALGH
REASON FOR REQUEST...WILDFIRE
```
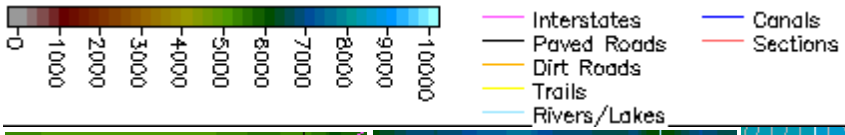


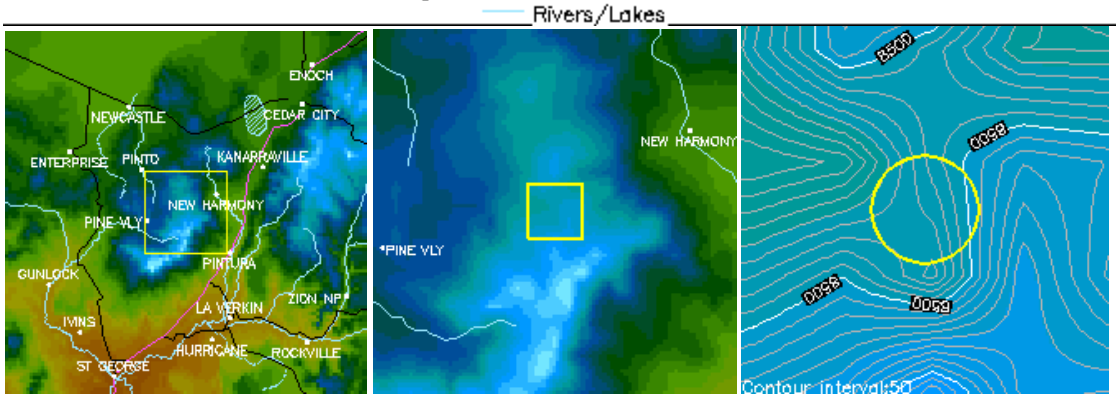
Appendix H

Mill Flat (WFU) (Requested: 1316 MDT 8/19/09)

Forecast complete at 1331 MDT 8/19/09

Requested by: Dixie NF





Location: Legal: Lat/Lon:37.4382/113.3924 Quad:Grass Valley
Calculated: (37°26'17"N 113°23'32"W) (GRASS VALLEY UT)

Elevation:8200-8836 Drainage:Dam Canyon Aspect:East Size:150

Fuel Type:Timber (Partially Sheltered)

Observations:

Place Elev Time Wind Temp Wetbulb RH Dewpt Remarks

Requested Parameters	Remarks
XXX LAL XXX Haines Index XXX Clearing Index XXX Sky/Weather XXX Temperature XXX Humidity XXX Wind - 20 Foot	Please use Lava Point RAWS (at similar elevation across valley, wind sensor reads 180 degrees from true) and/or Enterprise RAWS for observations, Dixie Port #4 is in Pine Valley but not consistent transmitting obs. Fire is in Pine Valley Wilderness and does not have anyone on scene at this time. Observed winds yesterday and today have been west/northwest. Particularly interested in winds and humidity recovery for next couple of days. Call with any questions. Thanks.

FORECAST:

IF CONDITIONS BECOME UNREPRESENTATIVE,
CONTACT THE NATIONAL WEATHER SERVICE.

SPOT FORECAST FOR MILL FLAT
NATIONAL WEATHER SERVICE SALT LAKE CITY UT

131 PM MDT WED AUG 19 2009

.DISCUSSION...HIGH PRESSURE WILL SLOWLY BUILD EAST ACROSS THE REGION
OVER THE NEXT FEW DAYS. MAINLY DIURNAL WIND SHIFTS ARE EXPECTED
THROUGH FRIDAY. AS HIGH PRESSURE SHIFTS FURTHER TO THE EAST
FRIDAY INTO SATURDAY...MIDLEVEL MOISTURE WILL BEGIN TO BUILD INTO
CENTRAL AND SOUTHERN UTAH. ISOLATED HIGH BASED THUNDERSTORMS ARE
POSSIBLE...ESPECIALLY ACROSS THE HIGHER TERRAIN BEGINNING
FRIDAY...WITH MORE COVERAGE EXPECTED SATURDAY.

.REST OF TODAY...
  LAL.................1.
  HAINES INDEX........5 ..MODERATE.
  CLEARING INDEX......570.
  SKY/WEATHER.........SUNNY (0-10 PERCENT CLOUD COVER).
  MAX TEMPERATURE.....79-81.
  MIN HUMIDITY........10-12 PERCENT.
  WINDS - 20-FOOT.....NORTHWEST 5 TO 10 MPH.

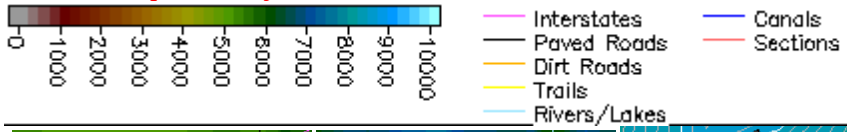
.TONIGHT...
  LAL.................1.
  HAINES INDEX........5 ..MODERATE.
  SKY/WEATHER.........CLEAR (0-10 PERCENT CLOUD COVER).
  MIN TEMPERATURE.....51-53.
  MAX HUMIDITY........33-35 PERCENT.
  WINDS - 20-FOOT.....NORTHWEST 5 TO 10 MPH BECOMING
                      DOWNSLOPE/DOWNVALLEY 2 TO 5 MPH AFTER
                      SUNSET.

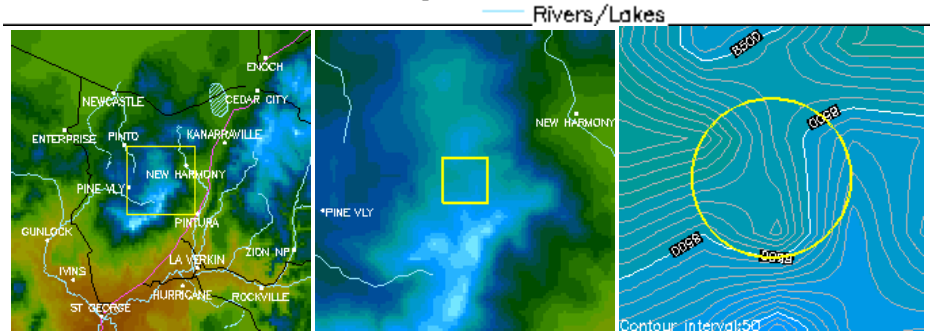
.OUTLOOK FOR THURSDAY...
  LAL.................1.
  HAINES INDEX........6 ..HIGH.
  CLEARING INDEX......410.
  SKY/WEATHER.........SUNNY (0-10 PERCENT CLOUD COVER).
  MAX TEMPERATURE.....78-80.
  MIN HUMIDITY........12-15 PERCENT.
  WINDS - 20-FOOT.....DOWNSLOPE/DOWNVALLEY 2 TO 5 MPH BECOMING
                      UPSLOPE/UPVALLEY 6 TO 10 MPH AFTER 1100.

FORECASTER...KRUSE
REQUESTED BY...KEVIN GREENHALGH
REASON FOR REQUEST...WFU

Appendix H

Mill Flat (WFU) (Requested: 1449 MDT 8/21/09) **Forecast complete at 1520 MDT 8/21/09** Requested by: CCIFC





Location: Legal: Lat/Lon:37.4382/113.3924 Quad:Grass Valley
Calculated: (37°26'17"N 113°23'32"W) (GRASS VALLEY UT)
Elevation:8200-8836 Drainage:Dam Canyon Aspect:East Size:479 Fuel Type:Timber (Partially Sheltered) **Observations:**

Place	Elev	Time	Wind	Temp	Wetbulb	RH	Dewpt	Remarks
* se flank	8825	1215	5s g12	78	53			
				Calculated:		23	37	
** w side fire	8676	1315	1-3 s g5	83	50			
				Calculated:		11	23	
***n flank	8610	1415	0-2 nw	80	51			
				Calculated:		16	30	

Requested Parameters

```
XXX LAL
XXX Haines Index
XXX Clearing Index
XXX   Sky/Weather
XXX   Temperature
XXX   Humidity
XXX   Wind - 20 Foot
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Remarks

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* south aspect
** east aspect
*** nw aspect

**IC would like tomorrow nite also
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FORECAST:

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IF CONDITIONS BECOME UNREPRESENTATIVE,
CONTACT THE NATIONAL WEATHER SERVICE.

SPOT FORECAST FOR MILL FLAT
NATIONAL WEATHER SERVICE SALT LAKE CITY UT
320 PM MDT FRI AUG 21 2009

.DISCUSSION...THE STRONG HIGH PRESSURE SYSTEM OVER THE AREA TODAY
WILL MOVE EAST INTO COLORADO BY EARLY SATURDAY. MOISTURE POOLED TO
THE SOUTH OVER ARIZONA WILL SURGE NORTH BEHIND THE EXITING HIGH...
RESULTING IN A FEW SHOWERS LATE TONIGHT...THEN SCATTERED
SHOWERS/THUNDERSTORMS WITH WETTING RAINS SATURDAY/SATURDAY EVENING. A
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LITTLE DRIER AIR WILL WORK INTO EXTREME SOUTHWEST UTAH SUNDAY...
RESULTING IN LESS SHOWER AND THUNDERSTORM ACTIVITY DURING THE DAY.

.REST OF TODAY...
  LAL.................1.
  HAINES INDEX........6 ..HIGH.
  CLEARING INDEX......560.
  SKY/WEATHER.........PARTLY CLOUDY (35-45 PERCENT CLOUD COVER).
  MAX TEMPERATURE.....82-84.
  MIN HUMIDITY........8-10 PERCENT.
  WINDS - 20-FOOT.....SOUTH SOUTHWEST WINDS 5 TO 10 MPH WITH GUSTS TO
                      15 MPH.

.TONIGHT...
  LAL.................1.
  HAINES INDEX........6 ..HIGH.
  SKY/WEATHER.........PARTLY CLOUDY (50-60 PERCENT CLOUD COVER). A
                      SLIGHT CHANCE OF SHOWERS AFTER 0300.
  MIN TEMPERATURE.....55-57.
  MAX HUMIDITY........32-34 PERCENT.
  WINDS - 20-FOOT.....SOUTHWEST WINDS 6 TO 12 MPH...BECOMING EAST
                      NORTHEAST WINDS 5 TO 10 MPH AFTER 2200.

.SATURDAY...
  LAL.................2 UNTIL NOON...THEN 4.
  HAINES INDEX........4 ..LOW.
  CLEARING INDEX......1000+.
  SKY/WEATHER.........MOSTLY CLOUDY (65-75 PERCENT CLOUD COVER).
                      ISOLATED SHOWERS AND THUNDERSTORMS IN THE
                      MORNING...THEN SCATTERED SHOWERS AND
                      THUNDERSTORMS IN THE AFTERNOON.
  MAX TEMPERATURE.....72-74.
  MIN HUMIDITY........26-28 PERCENT.
  WINDS - 20-FOOT.....WEST SOUTHWEST WINDS 12 TO 16 MPH.

.OUTLOOK FOR SATURDAY NIGHT...
  LAL.................4 UNTIL 2100...THEN 2.
  HAINES INDEX........4 ..LOW.
  CLEARING INDEX......1000+.
  SKY/WEATHER.........MOSTLY CLOUDY (70-80 PERCENT CLOUD COVER).
                      SCATTERED SHOWERS AND THUNDERSTORMS UNTIL
                      2100...THE ISOLATED SHOWERS AND THUNDERSTORMS.
  MIN TEMPERATURE.....53-55
  MAX HUMIDITY........66-69 PERCENT.
  WINDS - 20-FOOT.....SOUTHWEST WINDS 8 TO 14 MPH...INCREASING TO
                      14 TO 18 MPH WITH GUSTS TO 23 MPH AFTER 2100.



FORECASTER...CONGER
REQUESTED BY...KEVIN GREENHALGH
REASON FOR REQUEST...WFU
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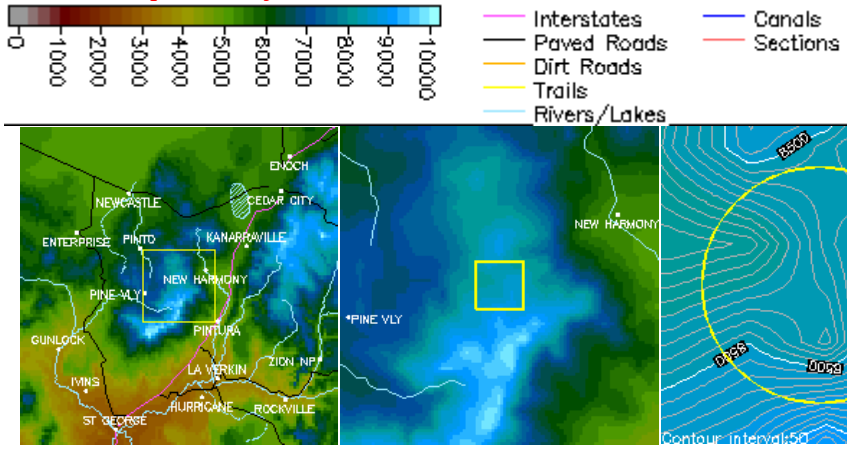
Appendix H

Mill Flat (WFU) (Requested: 855 MDT 8/24/09) **Forecast complete at 919 MDT 8/24/09** Requested by: Dixie NF



Location: Legal: Lat/Lon:37.4382/113.3924 Quad:Grass Valley
Calculated: (37°26'17"N 113°23'32"W) (GRASS VALLEY UT)
Elevation:8200-8836 Drainage:Dam Canyon Aspect:East Size:970 Fuel Type:Timber (Partially Sheltered) **Observations:**

Place Elev Time Wind Temp Wetbulb RH Dewpt Remarks

Requested Parameters	**Remarks**
XXX LAL XXX Haines Index XXX Clearing Index XXX Sky/Weather XXX Temperature XXX Humidity XXX Wind - 20 Foot	Please use Lava Point RAWS (at similar elevation across valley, wind sensor reads 180 degrees from true) and/or Enterprise RAWS for observations. Fire is in Pine Valley wilderness and does not have anyone on scene at this time. Observed winds yesterday were primarily out of the southeast, with occasional southwest at the fire site. Particularly interested in winds, humidity recovery and outlook for next several days. Call with any questions. Thanks.

FORECAST:

IF CONDITIONS BECOME UNREPRESENTATIVE,
CONTACT THE NATIONAL WEATHER SERVICE.

SPOT FORECAST FOR MILL FLAT
NATIONAL WEATHER SERVICE SALT LAKE CITY UT
919 AM MDT MON AUG 24 2009

.DISCUSSION...COOLER TEMPERATURES AND HIGHER HUMIDITIES WILL CONTINUE TODAY AS A SOMEWHAT MOIST AND UNSTABLE AIRMASS REMAINS OVER THE AREA. EXPECT ISOLATED TO WIDELY SCATTERED GENERALLY WET THUNDERSTORMS TO DEVELOP TODAY OVER AND NEAR THE BURN SITE AS WEAK DISTURBANCES CONTINUE TO MOVE THROUGH THE REGION. WINDS WILL BE A

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BIT LIGHTER TODAY. THE AIRMASS WILL GRADUALLY WARM AND DRY THROUGH
MIDWEEK.

.TODAY...
  LAL.................2 UNTIL 1200...THEN 3.
  HAINES INDEX........3 ..VERY LOW.
  CLEARING INDEX......1000+.
  SKY/WEATHER.........PARTLY CLOUDY (55-65 PERCENT CLOUD COVER).
                      WIDELY SCATTERED RAIN SHOWERS. ISOLATED
                      THUNDERSTORMS UNTIL 1200...THEN WIDELY
                      SCATTERED THUNDERSTORMS.
  MAX TEMPERATURE.....66-69.
  MIN HUMIDITY........39-42 PERCENT.
  WINDS - 20-FOOT.....NORTHWEST WINDS 3 TO 6 MPH BECOMING SOUTHEAST
                      5 TO 10 MPH WITH OCCASIONAL GUSTS TO 18 MPH
                      AFTER NOON.

.TONIGHT...
  LAL.................3 UNTIL MIDNIGHT...THEN 2.
  HAINES INDEX........3 ..VERY LOW.
  SKY/WEATHER.........PARTLY CLOUDY (50-60 PERCENT CLOUD COVER).
                      WIDELY SCATTERED SHOWERS AND ISOLATED
                      THUNDERSTORMS UNTIL MIDNIGHT...THEN
                      ISOLATED SHOWERS AND THUNDERSTORMS.
  MIN TEMPERATURE.....40-43.
  MAX HUMIDITY........65-68 PERCENT.
  WINDS - 20-FOOT.....SOUTHEAST WINDS 5 TO 10 MPH BECOMING
                      NORTHWEST 3 TO 6 MPH AFTER 2200.

.OUTLOOK FOR TUESDAY...
  LAL.................2.
  HAINES INDEX........4 ..LOW.
  CLEARING INDEX......690.
  SKY/WEATHER.........PARTLY CLOUDY (45-55 PERCENT CLOUD COVER).
                      ISOLATED SHOWERS AND THUNDERSTORMS.
  MAX TEMPERATURE.....67-70.
  MIN HUMIDITY........36-39 PERCENT.
  WINDS - 20-FOOT.....NORTHWEST WINDS 3 TO 6 MPH BECOMING SOUTHEAST
                      5 TO 10 MPH IN THE AFTERNOON.



FORECASTER...CHENG
REQUESTED BY...KEVIN GREENHALGH
REASON FOR REQUEST...WFU
```
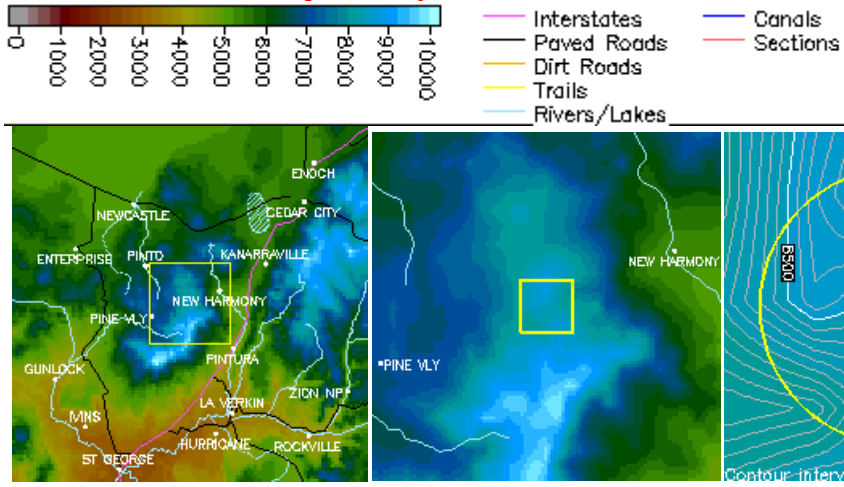


Appendix H

Mill Flat (WILDFIRE) (Requested: 1636 MDT 8/29/09) **Forecast complete at 1710 MDT 8/29/09** Requested by: MIFC



Location: Legal: Lat/Lon:37.4496/113.3919 Quad:Grass Valley
Calculated: (37°26'58"N 113°23'30"W) (GRASS VALLEY UT)
Elevation:8200-8836 Drainage:Dam Canyon Aspect:East Size:1109 Fuel Type:Timber (Partially Sheltered) **Observations:**

Place	Elev	Time	Wind	Temp	Wetbulb	RH	Dewpt	Remarks
on site		1400	0-2 g6 w	92	58	11		
on site		1500	g6 w	91	56	9		
on site		1600	g9 w	90	56	10		

Requested Parameters **Remarks**

```
XXX LAL
XXX Haines Index
XXX Clearing Index
XXX   Sky/Weather
XXX   Temperature
XXX   Humidity
XXX   Wind - 20 Foot
```

FORECAST:

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IF CONDITIONS BECOME UNREPRESENTATIVE,
CONTACT THE NATIONAL WEATHER SERVICE.

SPOT FORECAST FOR MILL FLAT
NATIONAL WEATHER SERVICE SALT LAKE CITY UT
510 PM MDT SAT AUG 29 2009

.DISCUSSION...A PACIFIC LOW PRESSURE SYSTEM WILL MOVE SOUTHEASTWARD
TONIGHT...REACHING CENTRAL IDAHO BY DAYBREAK SUNDAY...THEN SLIDE
EASTWARD ACROSS THE NORTHERN ROCKIES.  WINDS WILL INCREASE ON SUNDAY
AS THIS SYSTEM SLIDES BY TO THE NORTH.  A SLIGHTLY WEAKER FLOW CAN
BE EXPECTED ON MONDAY.  ISOLATED SHOWERS AND THUNDERSTORMS WILL BE
POSSIBLE IN THE VICINITY OF THE FIRE EARLY THIS EVENING WITH GUSTY
AND ERRATIC WINDS POSSIBLE NEAR ANY SHOWERS OR THUNDERSTORMS.
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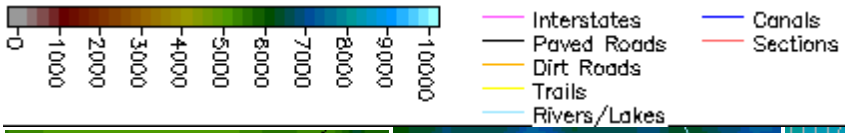
```
.TONIGHT...
  LAL.................2.
  HAINES INDEX........6 ..HIGH.
  SKY/WEATHER.........ISOLATED SHOWERS AND THUNDERSTORMS EARLY
                      THIS EVENING...OTHERWISE MOSTLY CLEAR
                      (20-30 PERCENT CLOUD COVER).
  MIN TEMPERATURE.....56-58.
  MAX HUMIDITY........33-35 PERCENT.
  WINDS - 20-FOOT.....WEST WINDS AROUND 10 MPH BECOMING SOUTHWEST.

.SUNDAY...
  LAL.................1.
  HAINES INDEX........5 ..MODERATE.
  CLEARING INDEX......1000+.
  SKY/WEATHER.........MOSTLY SUNNY (10-20 PERCENT CLOUD COVER).
  MAX TEMPERATURE.....80.
  MIN HUMIDITY........15-17 PERCENT.
  WINDS - 20-FOOT.....BREEZY. SOUTHWEST WINDS 10 TO 15 MPH
                      INCREASING TO 25 MPH LATE IN THE AFTERNOON.

.OUTLOOK FOR MONDAY...
  LAL.................1.
  HAINES INDEX........5 ..MODERATE.
  CLEARING INDEX......1000+.
  SKY/WEATHER.........MOSTLY SUNNY (15-25 PERCENT CLOUD COVER).
  MAX TEMPERATURE.....75-77.
  MIN HUMIDITY........17-19 PERCENT.
  WINDS - 20-FOOT.....SOUTHWEST WINDS 10 TO 15 MPH INCREASING TO 20
                      MPH LATE IN THE AFTERNOON.



FORECASTER...BARJENBRUCH
REQUESTED BY...INCIDENT COMMANDE
REASON FOR REQUEST...WILDFIRE
```

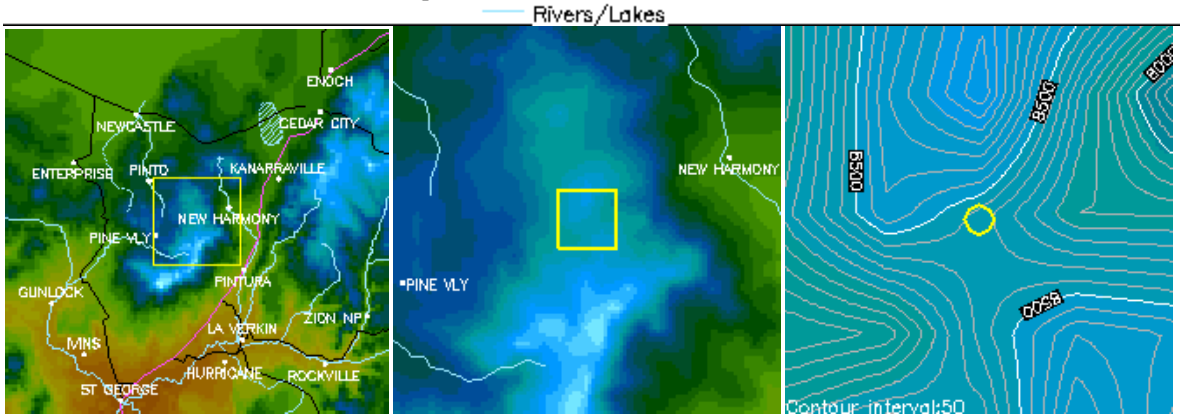

Appendix H

Mill Flat (WILDFIRE) (Requested: 1233 MDT 8/30/09)

Forecast complete at 1357 MDT 8/30/09

Requested by: CCIFC





Location: Legal: Lat/Lon:37.4496/113.3919 Quad:Grass Valley
Calculated: (37°26'58"N 113°23'30"W) (GRASS VALLEY UT)

Elevation:5500-9500 Drainage:Dam Canyon Aspect:East Size:10,000

Fuel Type:Timber, PJ (Partially Sheltered)

Observations:

Place	Elev	Time	Wind	Temp	Wetbulb	RH	Dewpt	Remarks
New Harmony	5400	0930	Calm	80		26	36	Clear w/ smoke haze
New Harmony	5400	1000	Calm SE	84		20	34	Clear w/ smoke haze
New Harmony	5400	1030	3-5 S, G10	84		15	na	Clear w/ smoke haze
New Harmony	5400	1100	3-5 S, G10	87		14	na	Clear w/ smoke haze

Requested Parameters

```
XXX LAL
XXX Haines Index
XXX Clearing Index
XXX   Sky/Weather
XXX   Temperature
XXX   Humidity
XXX   Wind - 20 Foot
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Remarks

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Want to have the spot back by
1400. Thanks!!
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FORECAST:

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IF CONDITIONS BECOME UNREPRESENTATIVE,
CONTACT THE NATIONAL WEATHER SERVICE.

SPOT FORECAST FOR MILL FLAT
NATIONAL WEATHER SERVICE SALT LAKE CITY UT
157 PM MDT SUN AUG 30 2009
```

...RED FLAG WARNING IN EFFECT THROUGH 9 PM MDT MONDAY...

.DISCUSSION...A PACIFIC SYSTEM CURRENTLY LOCATED ACROSS EASTERN OREGON WILL SLOWLY PUSH EASTWARD TODAY ACROSS SOUTHERN IDAHO...REACHING NORTHWEST WYOMING MONDAY. AHEAD OF THIS SYSTEM...WINDY CONDITIONS WILL CONTINUE ACROSS THE MILL FLAT FIRE PERIMETER TODAY INTO TONIGHT. WINDY CONDITIONS ARE EXPECTED TO REDEVELOP BETWEEN 1000 AND 1200 MONDAY MORNING. AS THE PACIFIC SYSTEM PULLS AWAY FROM THE AREA TUESDAY AND HIGH PRESSURE BEGINS TO BUILD IN...WINDS WILL DECREASE WITH A SLIGHT INCREASE IN MINIMUM HUMIDITIES EXPECTED. HIGH PRESSURE WILL REMAIN IN PLACE THROUGH FRIDAY.

A RED FLAG WARNING IS IN EFFECT FOR THE AREA THROUGH MONDAY EVENING. WINDS WILL LIKELY FALL BELOW CRITERIA AFTER BETWEEN 2200-2400 TONIGHT WITH POOR HUMIDITY RECOVERIES.

.REST OF TODAY...
  LAL.................1.
  HAINES INDEX........5 ..MODERATE.
  CLEARING INDEX......1000+.
  SKY/WEATHER.........MOSTLY SUNNY (15-25 PERCENT CLOUD COVER).
  MAX TEMPERATURE.....91-93.
  MIN HUMIDITY........12-14 PERCENT.
  WINDS - 20-FOOT.....SOUTHWEST WINDS 15 TO 25 MPH WITH GUSTS TO
                      35 MPH. SHELTERED LOCATIONS...ESPECIALLY
                      THOSE PROTECTED TO THE SOUTH AND WEST WILL
                      SEE LIGHTER WINDS.

.TONIGHT...
  LAL.................1.
  HAINES INDEX........5 ..MODERATE.
  SKY/WEATHER.........MOSTLY CLEAR (10-20 PERCENT CLOUD COVER).
  MIN TEMPERATURE.....56-58.
  MAX HUMIDITY........29-31 PERCENT.
  WINDS - 20-FOOT.....SOUTHWEST WINDS 15 TO 25 MPH WITH
                      GUSTS TO 35 MPH DECREASING TO 10 TO 20 MPH
                      AFTER MIDNIGHT. SHELTERED
                      LOCATIONS...ESPECIALLY THOSE PROTECTED TO
                      THE SOUTH AND WEST WILL SEE LIGHTER
                      WINDS ESPECIALLY LATE TONIGHT INTO EARLY
                      MORNING.

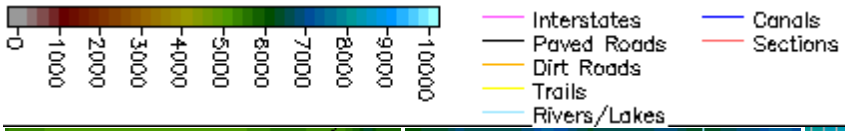
.OUTLOOK FOR MONDAY...
  LAL.................1.
  HAINES INDEX........5 ..MODERATE.
  CLEARING INDEX......1000+.
  SKY/WEATHER.........MOSTLY SUNNY (15-25 PERCENT CLOUD COVER).
  MAX TEMPERATURE.....90-92.
  MIN HUMIDITY........12-14 PERCENT.
  WINDS - 20-FOOT.....SOUTHWEST WINDS 10 TO 15 MPH INCREASING TO
                      15 TO 25 MPH WITH GUSTS TO 35 MPH AFTER 1000.
FORECASTER...KRUSE
REQUESTED BY...CAROL HENSON
REASON FOR REQUEST...WILDFIRE

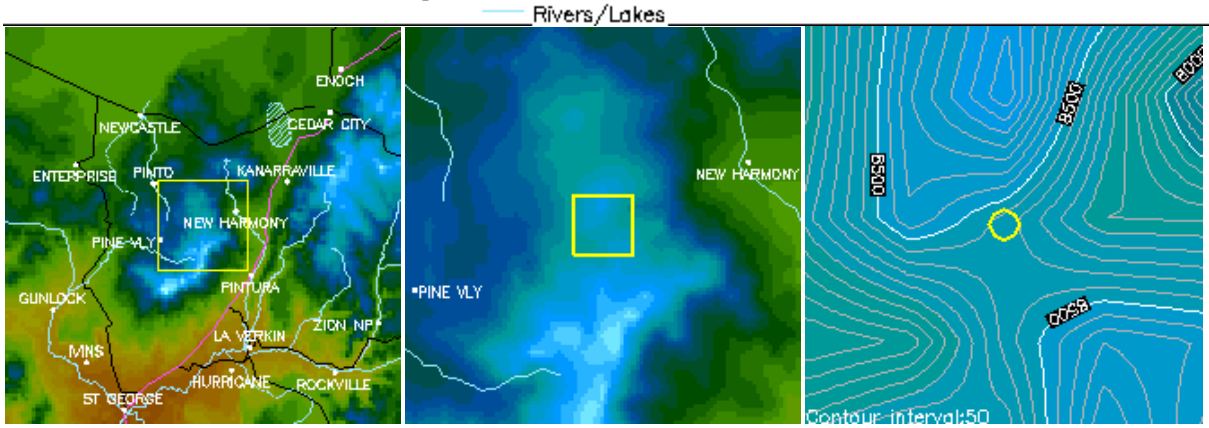
Appendix H

Mill Flat (WILDFIRE) (Requested: 424 MDT 8/31/09)

Forecast complete at 448 MDT 8/31/09

Requested by: CCIFC





Location: Legal: Lat/Lon:37.4496/113.3919 Quad:Grass Valley
Calculated: (37°26'58"N 113°23'30"W) (GRASS VALLEY UT)

Elevation:5500-9500 Drainage:Dam Canyon Aspect:East Size:10,000

Fuel Type:Timber, PJ (Partially Sheltered)

Observations:

Place Elev Time Wind Temp Wetbulb RH Dewpt Remarks

Requested Parameters Remarks

```
XXX LAL
XXX Haines Index
XXX Clearing Index
XXX   Sky/Weather
XXX   Temperature
XXX   Humidity
XXX   Wind - 20 Foot
```

FORECAST:

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IF CONDITIONS BECOME UNREPRESENTATIVE,
CONTACT THE NATIONAL WEATHER SERVICE.

SPOT FORECAST FOR MILL FLAT
NATIONAL WEATHER SERVICE SALT LAKE CITY UT
448 AM MDT MON AUG 31 2009

...RED FLAG WARNING FOR GUSTY SOUTHWEST WINDS AND LOW RELATIVE
HUMIDITY IN EFFECT UNTIL 9 PM MDT THIS EVENING...

.DISCUSSION...A VERY DRY AIRMASS REMAINS IN PLACE AT THE FIRE
SITE THIS MORNING...WHICH HAS RESULTED IN GENERALLY POOR
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OVERNIGHT RH RECOVERY. WITH SOUTHWEST WINDS INCREASING ONCE
AGAIN THIS AFTERNOON SEVERE FIRE CONDITIONS CONDITIONS CAN BE
EXPECTED THROUGHOUT MUCH OF THE AFTERNOON AND EARLY EVENING.

HIGH PRESSURE WILL BEGIN TO BUILD INTO THE REGION TONIGHT
THROUGH TUESDAY...THEN REMAIN IN PLACE THROUGHOUT MUCH OF THE
REMAINDER OF THE WEEK. ALTHOUGH THE AIRMASS WILL GENERALLY
REMAIN DRY WITHIN THE LOWER LEVELS...WINDS ARE EXPECTED TO
DIMINISH CONSIDERABLY AND BECOME MORE DOMINATED BY SLOPE FLOWS
WITH TIME. HIGH BASED MOISTURE IS EXPECTED TO SPREAD NORTH INTO
THE REGION LATE TUESDAY INTO WEDNESDAY...BRINGING A THREAT FOR
AFTERNOON BUILDUPS ALONG WITH AN ISOLATED DRY THUNDERSTORM OR
TWO TUESDAY INTO WEDNESDAY.

.TODAY...
  LAL.................1.
  HAINES INDEX........5 ..MODERATE.
  CLEARING INDEX......1000+.
  SKY/WEATHER.........MOSTLY SUNNY (10-20 PERCENT CLOUD COVER).
  MAX TEMPERATURE.....89-92 NEAR 5500 FEET...74-77 AT THE UPPER
                      ELEVATIONS.
  MIN HUMIDITY........8-12 PERCENT.
  WINDS - 20-FOOT.....SOUTHWEST 5-10 MPH...INCREASING TO 15-20
                      MPH WITH GUSTS TO 35 MPH AFTER 1100.

.TONIGHT...
  LAL.................1.
  HAINES INDEX........4 ..LOW.
  SKY/WEATHER.........MOSTLY CLEAR (25-35 PERCENT CLOUD COVER).
  MIN TEMPERATURE.....53-57.
  MAX HUMIDITY........27-30 PERCENT.
  WINDS - 20-FOOT.....SOUTHWEST 15-20 MPH WITH GUSTS TO 30 MPH
                      UNTIL 2100...THEN DECREASING AND BECOMING
                      WEST 5-10 MPH BY MIDNIGHT.

.OUTLOOK FOR TUESDAY...
  LAL.................1 UNTIL NOON...THEN 2.
  HAINES INDEX........5 ..MODERATE.
  CLEARING INDEX......1000+.
  SKY/WEATHER.........MOSTLY SUNNY (25-35 PERCENT CLOUD COVER) THEN
                      BECOMING PARTLY CLOUDY (40-50 PERCENT CLOUD
                      COVER). A FEW AFTERNOON BUILDUPS WITH AN
                      ISOLATED DRY THUNDERSTORM OR TWO POSSIBLE.
  MAX TEMPERATURE.....89-92 NEAR 5500 FEET...74-77 AT THE UPPER
                      ELEVATIONS.
  MIN HUMIDITY........12-16 PERCENT.
  WINDS - 20-FOOT.....SOUTHWEST 6-12 MPH.
FORECASTER...SEAMAN
REQUESTED BY...FOREST SERVICE
REASON FOR REQUEST...WILDFIRE
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Appendix H

Appendix I: Policy

A chronology and discussion of the policy changes is provided here to help provide context for some of the organizational conditions associated with the Mill Flat Fire. Materials related to the Federal Fire Policy are available at http://www.nwcg.gov/branches/ppm/fpc/archives/fire_policy/index.htm.

1995

The *Review and Update of the 1995 Federal Wildland Fire Management Policy (January 2001)* is the primary interagency wildland fire policy document.

2003

The *Interagency Strategy for the Implementation of Federal Wildland Fire Management Policy (June 20, 2003)* was developed and approved under the authority of the Wildland Fire Leadership Council (WFLC) to set forth direction for consistent implementation of the federal fire policy.

2008

On May 2, 2008, the WFLC issued a memorandum entitled *Modification of Federal Wildland Fire Policy Guidance*. This memorandum directed federal agencies to test and implement new guidelines for wildland fire management. The modifications were tested in a number of field units in the 2008 fire season.

2009

On January 7, 2009, the National Wildfire Coordinating Group (NWCG) issued a memorandum (NWCG#001-2009) to the NWCG executive board that

1. affirmed the soundness of the *Review and Update of the 1995 Federal Wildland Fire Management Policy (January 2001)*,
2. reiterates the policy changes stated in the May 2, 2008 WFLC memorandum entitled *Modification of Federal Wildland Fire Policy Guidance*,
3. states that the Wildland Fire Decision Support System (WFDSS) will replace existing analysis and decision processes, and
4. confirms that the *Interagency Strategy for the Implementation of Federal Wildland Fire Management Policy (June 20, 2003)* will be replaced in 2009.

On February 2, 2009, Forest Service Deputy Chief Hubbard announced the implementation schedule for the WFDSS. The WFDSS (http://wfdss.usgs.gov) project evolved from the need to streamline and improve wildland fire decision-making processes, as well as take advantage of improvements in technology, fire modeling, and geospatial analysis. The WFDSS provides a scalable decision support tool that helps agency administrators and wildland fire managers make informed decisions for all unplanned ignitions. The WFDSS uses appropriate fire behavior modeling, economic principles, and information technology to support effective wildland fire decisions consistent with Resource and Fire Management Plans.

The WFDSS and its reporting components were designed to: 1) support the Federal Wildland Fire Policy implementation guidance update (2009) and 2) replace three existing decision analysis processes - the Wildland Fire Situation Analysis (WFSA), the Wildland Fire Implementation Plan (WFIP), and the Long-Term Implementation Plan (LTIP).

Use of the WFDSS was to be phased in nationally between April 2009 and September 2009. Beginning April 1, 2009, agency administrators were authorized to use the WFDSS decision analysis process and the Decision Analysis Report, for unplanned wildland fires in lieu of the three existing decision analysis processes. Full transition to the DAR was to be complete for Region 4, including the Dixie National Forest, by July 1, 2009 for those fires requiring one of the current decision analysis processes, including all unplanned wildland fires which are managed for multiple objectives. By September 1, 2009 all agency field units were to be entering all unplanned wildland fires into the WFDSS system, in addition to using the DAR.

The national WFDSS Training strategy relied heavily on e-learning opportunities (webinars) which were supplemented by Regional activities and materials to assist users in getting the most out of WFDSS. Training via webinars began on February 19, 2009.

In late February 2009 the Chair of the Fire Executive Council (FEC) forwarded the Chief of the Forest Service the replacement, *Guidance for Implementation of Federal Wildland Fire Management Policy (February, 2009).*

In February 2009, in light of changes in implementation guidance, the National Wildfire Coordinating Group (NWCG), Fire Use Working Team (FUWT), and Training Working Team reviewed the Fire Use Manager positions (FUM1 and FUM2). The Fire Use Working Team submitted a proposal recommending that the two FUMA positions be merged into a single position, the Strategic Operational Planner (SOPL). The FUWT found that the FUMA skills remain relevant for wildfires managed for multiple objectives as well as any long term wildfire. FUMAs could provide expertise and experience in developing courses of action and mitigation measures to assess trade-offs between risks, costs, and benefits. However, because the WFIP process would be replaced by WFDSS, policy would no longer require FUMAs to be assigned to any wildfire. Previously a FUMA was required when completing a WFIP Stage 3.

On April 1, 2009, the FUWT released the Fire Use Manager 1 and 2 to Strategic Operational Planner Transition Plan (http://www.nwcg.gov/pms/docs/sopl-transition-plan.pdf). This plan established the role of the SOPL as:

> *"To coordinate the development of the course of action for the Wildland Fire Decision Support System (WFDSS) Response Level 3 (RL3) decision document. The SOPL will also provide technical expertise for the incident to meet Land Use Plan (LUP) and Fire Management Plan (FMP) objectives. The position will work under a qualified IC based on complexity level of incident. A qualified SOPL is recommended to take the lead coordinator role for any development of the course of action for the RL3 WFDSS decision document. If it's not possible, it's recommend that a review of the RL3-DAR is completed by a qualified SOPL. The host unit responsible for managing the event will be responsible for the completion of the WFDSS response level 3."*

Appendix I

The transition plan was not formally transmitted to field units by NWCG and did not receive wide distribution in many geographic areas. In many cases individuals were first made aware of the transition from FUMA to SOPL when they were issued a new incident qualifications card ("Redcard") reflecting the change.

On April 1, 2009 by signature to the 2009 Color Country Annual Operating Plan the Dixie NF and interagency partners decided to fully transition to WFDSS to document Wildland Fire Decisions (page 19) and conducted a preseason wildfire scenario, including the use of WFDSS on June 11, 2009.

Although many units had already received copies of the revised federal fire policy implementation guidance following FEC's approval, it was not until April 2009 that the Chief of the Forest Service formally issued the February 2009 *Guidance for Implementation of Federal Wildland Fire Management Policy* to field units.

Chief Kimball in her April 9, 2009 letter to the Regional Forester's stated *"to be clear, the 1995/2001 Federal Fire policy is affirmed and sound. Any management response to a wildland fire on federal land will continue to be based on objectives established in the applicable Land/ Resource Management Plan. Also, there is no change in the objective for initial attack actions on human-caused wildfire. We will continue to suppress fire to minimize negative consequences with respect to firefighter and public safety."*

The primary changes in the revised implementation guidance were:

- Changes in Terminology - Wildland fire is a term describing any non-structure fire that occurs in the wildland. Wildland fires are categorized into two distinct types[1]:
    - Wildfires – Unplanned ignitions and planned ignitions that are declared wildfires. The wildfire term is to be applied to all unplanned ignitions, including events formally termed wildland fire use.
    - Prescribed fires – Planned ignitions.

- A wildland fire may be concurrently managed for one or more objectives and those objectives can change as the fire spreads across the landscape, encountering new fuels, weather, social conditions, and governmental jurisdictions.

[1] The 2003 implementation guidance recognized three (3) kinds of wildland fire: **wildfire, wildland fire use** and **prescribed fire.**

Wildfire. An unplanned, unwanted wildland fire, including unauthorized human-caused fires, escaped wildland fire use events, escaped prescribed fire projects, and all other wildland fires where the objective is to put the fire out.

Wildland Fire Use. The application of the appropriate management response to naturally ignited wildland fires to accomplish specific resource management objectives in predefined designated areas outlined in Fire Management Plans.

Prescribed Fire. Any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist, and NEPA requirements (where applicable) must be met, prior to ignition.

The revised Implementation Guidance also reaffirmed the need to work collaboratively with State, local and tribal fire managers as well as public and nongovernmental organizations in the management of wildland fire. It also emphasizes the need to prepare fire management plans which are intergovernmental in scope and at a landscape scale and help prepare for the eventuality of wildland fire.

The revision allows fire managers to manage a fire for multiple objectives and increase managers' flexibility to respond to changing incident conditions and firefighting capability while strengthening strategic and tactical decision implementation supporting public safety and resource management objectives.

At the time of the release of the WFDSS implementation, actions to modify agency manuals and handbooks to support implementation of the new decision documentation and analysis process and the Federal Wildland Fire Policy implementation guidance update were just being implemented but were not complete prior to the start of the 2009 fire season.[2]

The Interagency Fire Management Plan (FMP) for the Dixie National Forest, Bryce Canyon National Park and Cedar Breaks National Monument was finalized on May 15, 2009. Guidance for the transition to the WFDSS and the revised fire policy implementation guidance were incorporated into the FMP as well as could be expected given the short time frame from the release of the revised guidance. The FMP retained many of the elements and terminology that were developed in support of the Wildland Fire Use program including use of a FUMA and a Fire Size-Up and Decision Checklist (FMP page 35)

On May 18, 2009, Regional Forester Harv Forsgren, in a letter to all R4 Forest Supervisors, provided his expectations for the 2009 Fire Season. In summary, they were "all about making better decisions". In this context he expected units to effectively engage fire management partners and local elected officials early in the decision process – including identification of values at risk, understanding probabilities of success, and managing risk to incident responders. Units were directed to use the decision support tools and Key Decision Log to help build social capacity.

In June, 2009, the FUWT revised the Fire Use Manager 1 and 2 to Strategic Operational Planner Transition Plan. This revision was not posted to the FUWT web page nor distributed to the fire community.

Between April 1, 2009 and August 29, 2009 the Dixie NF initialized 43 incidents in WFDSS. Decisions were published[3] on 9 incidents ranging in (final) size from 0.1 to 12,607 acres. The remaining fires were successfully managed utilizing the pre-planned initial attack response. During the 2009 fire season the Dixie National Forest and

[2] As of the date of this report updates to agency handbooks and manual guidance was still a work in progress.
[3] In WFDDS the term published is synonymous with approval by an Agency Administrator with delegated authority for wildland fire.

interagency partners successfully managed multiple incidents using the full flexibility afforded by the revised implementation guidance and supported by the WFDSS process.

Appendix I

Appendix J: Five Principles of Mindfulness

The following table is a summary of each of the five principles of mindfulness. The table first defines the principle then describes what that principle would look like when practiced in the field, then poses a series of open-ended questions, that when discussed, will enlarge one's perspectives about fire operations.

Preoccupation with failure	Operating with a chronic wariness of the possibility of unexpected events that might jeopardize the operation/project by engaging in proactive and preemptive analysis and discussion.	Articulate mistakes you don't want to make Treat lapses as signals Encourage error reporting Learn from near misses and errors Be wary of complacency	What are you counting on to happen/not happen? What do you expect from what you count on? In what ways can those things you count on fail? How can we position ourselves/organization to notice 'error' or deviations from expected? How can we organize ourselves to hear and communicate?
Reluctance to simplify	Taking deliberate steps to question assumptions and received wisdom to create a more nuanced picture of ongoing operations.	Be skeptical of assumptions, received wisdom Reconcile differences of opinion while maintaining nuances of meaning Recognize that similarities mask deeper differences	How is the current situation different from my expectation, from my slide of a similar event? What would indicate a difference, or a change in system behavior?
Commitment to resilience	Developing capabilities to detect, contain and bounce back from errors that have already occurred, but before they worsen and cause more serious harm.	Errors don't disable Detect, contain, bounce back from the inevitable Game out possibilities together Cultivate a deep knowledge of fire and your organization	Is there enough slack in this system? How fatigued are my resources; do I need to call for more? What are my alternatives and contingencies? How might I handle 'x'? Is there a training opportunity here?
Sensitivity to operations	Ongoing interaction and information sharing about the human and organizational factors that determine the safety and functioning of the whole system.	Publicly puzzle through a situation, public sense-making Be attentive to the here and now Notice and discuss accumulating deviations from expectations Know when to update your assumptions/expectations Pay attention to relationships	Where is my attention? How does that relate to our preoccupation with failure and our expectations? Where are the most sensitive sensors, operations? How are communications flowing? What's going on there?
Deference to expertise	During high-tempo times decision making authority migrates to the person/unit with the best perspective or most expertise with the problem at hand, regardless of their rank.	Develop and communicate a flexible decision structure Get to know each 's capabilities and experiences Get critical information from the person best positioned to see or know.	Who is in a position to notice? Who knows what – now, and from previous experience? Who has the expertise, attitude, knowledge?

Appendix K:Predicted Fire Behavior from Models and Tools

Behave Plus Prediction

The BehavePlus model was used to predict the fires rate of spread and flame length for August 29, 2009. The BehavePlus fire modeling system is a PC-based program that is a collection of models that describe fire behavior, fire effects, and the fire environment. It is a flexible system that produces tables, graphs, and simple diagrams and can be used for a multitude of fire management applications. BehavePlus is the successor to the BEHAVE fire behavior prediction and fuel modeling system (Andrews P. , 1986) (Andrews & Chase, 1989) (Burgan & Rothermel, 1984). It is called the BehavePlus fire modeling system to reflect its expanded scope. Development continues with the addition of fire modeling capabilities and features to facilitate application.

Inputs: SURFACE

Input Variables		Units	Input Value(s)
Fuel/Vegetation, Surface/Understory			
	Fuel Model		sh7
Fuel Moisture			
	1-h Moisture	%	2
	10-h Moisture	%	3
	100-h Moisture	%	5
	Live Woody Moisture	%	65, 70, 75
Weather			
	Midflame Wind Speed	mi/h	0.0, 2.5, 5.0, 7.5, 10.0
	Direction of Wind Vector (from upslope)	deg	180
Terrain			
	Slope Steepness	%	30

Results for: Surface Rate of Spread (maximum) (ch/h)

Live Wood Moisture mi/h	Midflame Wind Speed mi/h				
	0	2.5	5	7.5	10
65	10.2	20.7	52.6	87.6	124.8
70	9.6	19.5	49.6	82.6	117.7
75	9.1	18.4	46.9	78.1	111.3

Results for: Flame Length (ft)

Live Wood Moisture mi/h	Midflame Wind Speed mi/h				
	0	2.5	5	7.5	10
65	7.9	10.9	16.7	21.2	24.9
70	7.6	10.6	16.2	20.5	24.1
75	7.4	10.2	15.7	19.9	23.4

Figure 8

WFDSS Analyst Assisted Short-term Fire Behavior

WFDSS Analyst Assisted Short-term Fire Behavior was used to show the direction of spread for the fire on August 29, 2009. The analyst assisted STFB is essentially FlamMap (Finney, 2006a) using Minimum Travel Time (MTT). It has been available in WFDSS for a very short time. MTT is used to identify major pathways of fire spread (red "lightning bolts") —those routes that go on to burn the most acreage (Finney, 2002). To do this, a rectangular lattice is draped over a FARSITE LCP. STFB calculates 2-D spread rates and a max spread direction at each cell. Holding all environmental conditions constant, the MTT algorithm searches for the fastest path of fire spread along straight-line transects connected by nodes (cell corners) (Finney, 2006b). MTT pathways are then interpolated to reveal the fire perimeter positions at an instant in time. These perimeters are similar to wave-front expansion (FARSITE) but are mathematically and computationally more efficient (Stratton, 2009).

Short Term Fire Behavior Analysis Information

NAME	VALUE
Analysis Name	Short_term_8_28perm_1day__LN40FM_prod12
Burn Period	10 hours
Number of Burn Periods	1
Analysis Date/Time	08/29/2009 13:00 CDT
Wind Speed	14 mph
Wind Direction	285° azimuth
Top Latitude	37.5263 N
Bottom Latitude	37.3385 N
Left Longitude	113.483 W
Right Longitude	113.263 W
Landscape Resolution	30.0 meters
Gridded Wind Resolution	30 meters

Major Path: Straight Canyon and Dam Canyon

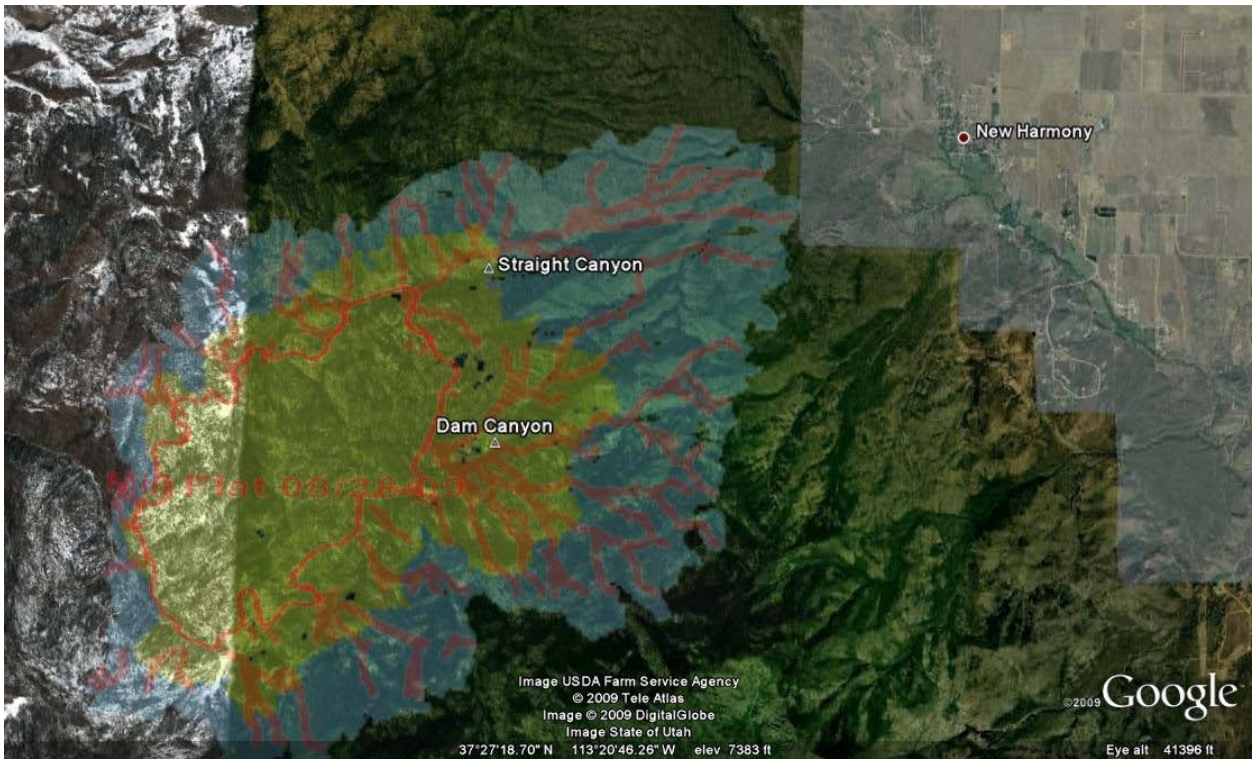


Figure 9

Fire Spread Probability (FSPro)

Fire spread probability (FSPro) is a two-dimensional spatial fire growth model that calculates the probability of fire movement using a FARSITE LCP (landscape file) (Finney, 1998). *Its output is not a fire perimeter*. A simple way to think of FSPro is: MTT + RERAP + a few extras (e.g. autocorrelation) = FSPro. FSPro input includes an ignition file, forecast, RAWS data for weather (ERC and fuel moisture) and wind, and an LCP. Using a time series approach, FSPro creates thousands of artificial seasons and models fire behavior and movement. The output is a probabilistic surface (1 to 100 percent) of fire movement over a given time period (e.g. 14 days). The season-end is accounted for when the ERC falls below a user-defined value, resulting in no fire spread.

FSPro General Information

NAME	VALUE
Analysis Name	Perm_8_25_500fires_FM147_NP_7days_project3
Analyst Name	Parker, Rick
Requested	10/01/2009 13:00
Completed	
Analysis Status	Review
Analysis Start	08/26/2009
Duration	7 days
Simulations	512 fires
Perimeter	Mill Flat 08/25/09
Barrier	No barrier specified
ERC Station	422803 - ENTERPRISE

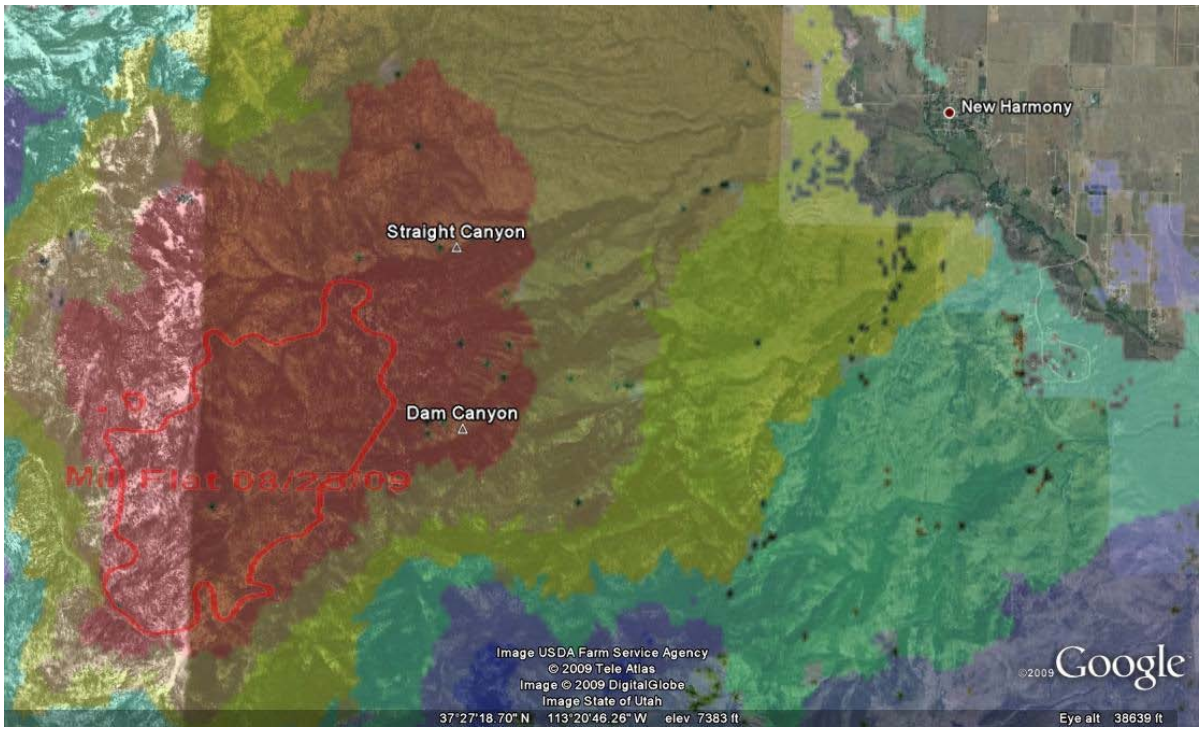
FSPro General Information

Winds Station	422803 - ENTERPRISE
Landscape Resolution	30 meters

FSPro Fire Sizes

FIRE SIZE	ACRES
Average Size	25,642
90th Percentile	65,307
70th Percentile	30,112
50th Percentile	12,689
30th Percentile	5,624
10th Percentile	2,641
Largest Fire	159,923

Figure 10



Fire Spread Probability

- 80-100%
- 60-79%
- 40-59%
- 20-39%
- 5-19%
- 0.2-4.9%
- < 0.2%