United States
Department of
Agriculture

Forest
Service

Southwestern
Region

Wallow Fire 2011

Large Scale Event Recovery

Rapid Assessment Team

Fire/Fuels Report

Apache-Sitgreaves National Forests

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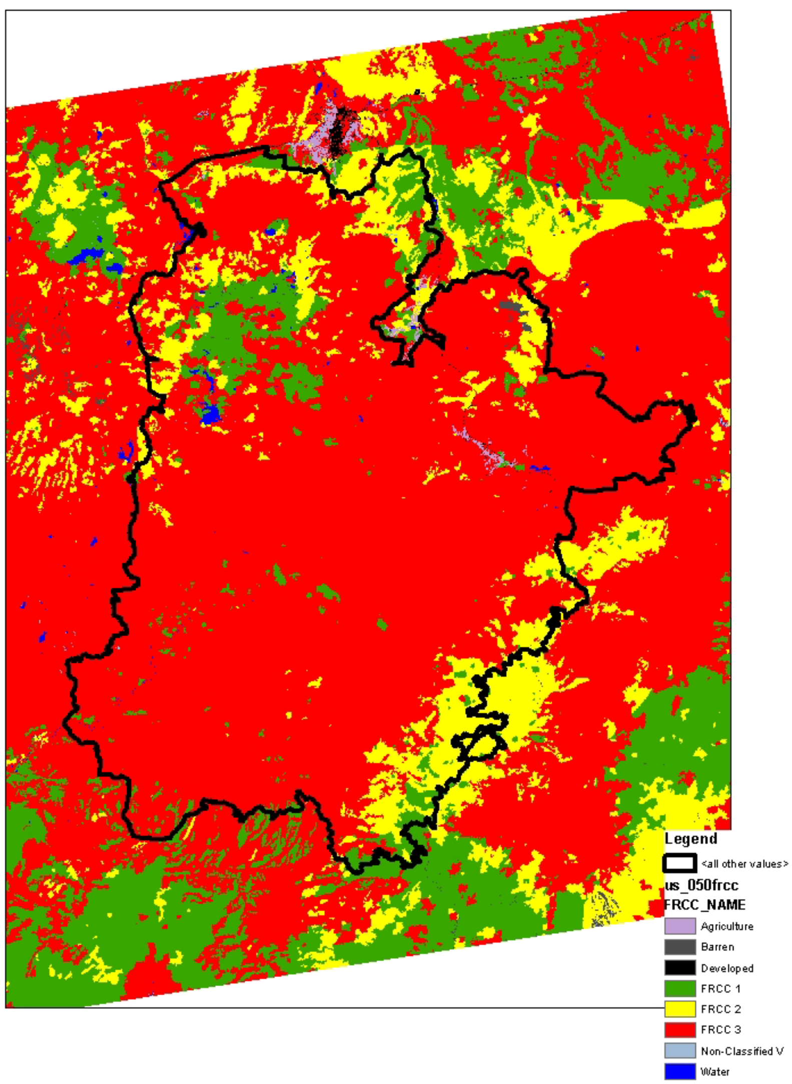
Summary of Event

The Wallow Fire started May 29, 2011, at the height of the Apache-Sitgreaves National Forests fire season, when strong southwest winds and low humidities are prevalent and frequent. The 2011 fire season was intensified by the combination of a lack of 2010-11 winter precipitation, and high loading of fine grass fuels remaining from the previous year. Combine this with forest and range vegetation well outside the historical range of variability for fuel conditions (see map of Pre-Wallow Burn FRCC and table of FRCC by Vegetation Type below), and the stage was set for uncharacteristic fire intensity and severity. The strong winds and extremely low fuel moistures resulted in mainly wind driven fire behavior, with the Wallow Fire making large gains within the first days of its' origin. Highlighting the severe fire conditions this spring, the Wallow fire burned over 535,000 acres in approximately 5 weeks, while during the last 25 years, acres burned on the Apache-Sitgreaves National Forests from both planned and unplanned ignitions totaled 581,000 acres. (Palmer, 2011)

Pre-Wallow Burn Fire Regime Condition Class with Fire Perimeter



FRCC 2 and 3 designations mean that fire behavior potential and vegetation structure are well outside their historic range of variability (see map above), setting the stage for uncharacteristic disturbance effects. FRCC 1 means that fire behavior and vegetation structure are within the historic range of variability and there is much less risk of losing key ecosystem components from a disturbance (Source: www.Landfire.gov, accessed 7/24/2011).

Pre-burn FRCC by vegetation type

Vegetation Type (PNVT)	**FRCC**	**Vegetation Type (PNVT)**	**FRCC**
Ponderosa Pine Forest	3	Great Basin Grassland	2
Dry Mixed Conifer Forest	3	Semi-desert Grassland	3
Wet Mixed Conifer Forest	2	Montane/Subalpine Grassland	2
Spruce Fir Forest	2	Cottonwood-Willow Riparian	2
Madrean Pine-Oak Woodland	3	Mixed Broadleaf Deciduous Riparian	1

(Palmer, 2011, unpublished Fuels Specialist Report)

Post-Wallow Fire Effects

The Wallow ABAER Report (2011) stated that the fire burned multiple vegetation types including ponderosa pine, mixed conifer, spruce-fir, pinyon-juniper, mountain grasslands and riparian types. Because fire behavior varies widely depending on fuels conditions and weather at the time of the fire, is it helpful to classify fire intensity and severity to understand post-fire effects. Actual fire behavior is described as fire intensity and post-fire effects are expressed in fire severity. Fire intensity is defined as the amount of heat generated by an active fire, and is usually expressed as heat per unit area of flaming front or just as flame length. Debano et al. (1998) describes fire severity as the ecosystems response to fire such as changes in dominant vegetation and soil conditions, while fire intensity expresses the amount and rate of surface fuel consumption.

The Burned Area Reflectance Classification process found that approximately 17% of the Wallow Fire experienced high soil burn severity (see following table), 14% in moderate and the remaining 69% in low and unburned. An example of The Rapid Assessment of Vegetation Condition After Wildfire (RAVG) is presented in the following table for ponderosa pine and mixed conifer pre-burn vegetation.

Acres and Percent by Burn Severity Class for the Wallow Fire Burn area (Data as of June 24, 2011 finalized BARC map)

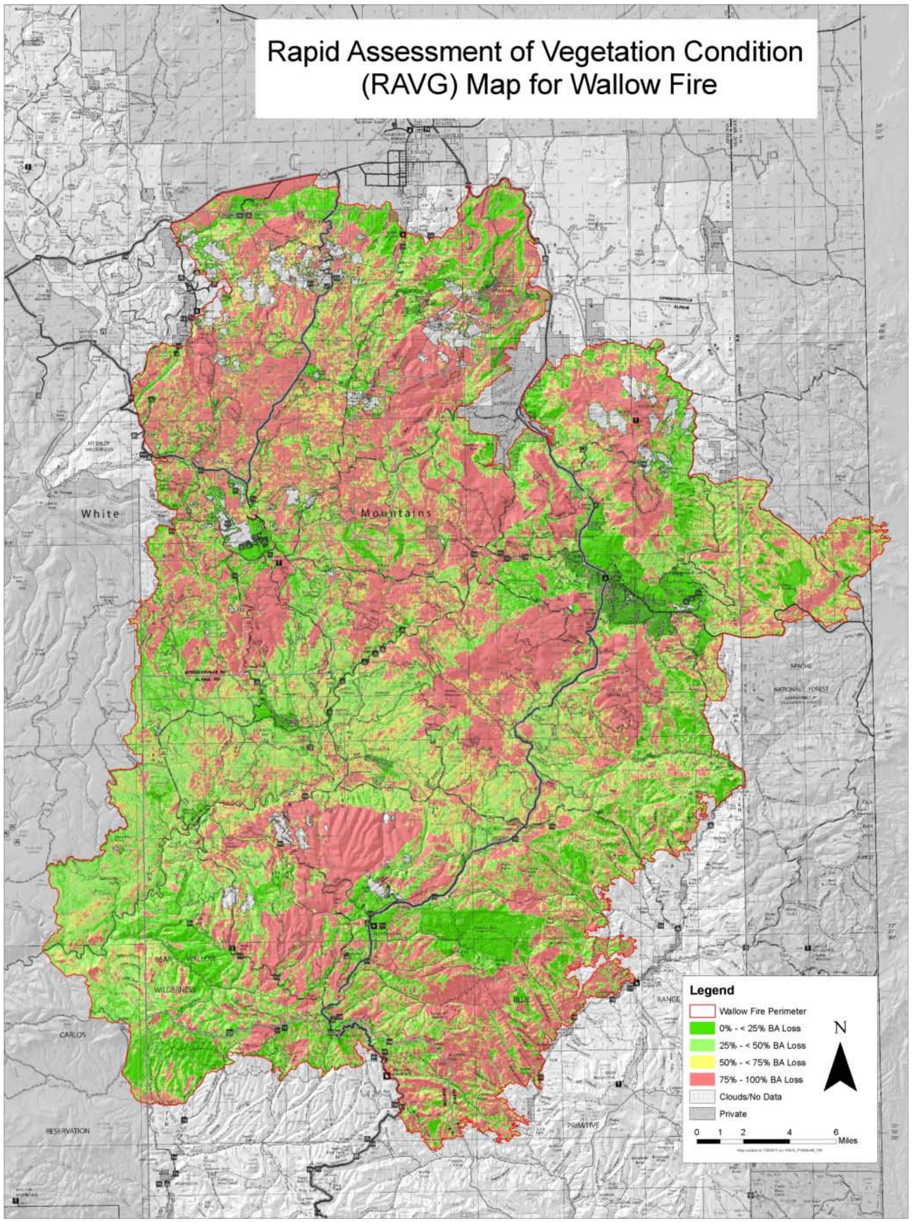
Soil Burn Severity Acreage					
Severity	Unburned	Low	Moderate	High	Total
Acres	114,811	237,058	72,243	85,753	509,865
Percent*	22	47	14	17	100

(From Wallow Fire BAER Report Executive Summary, July, 2011)

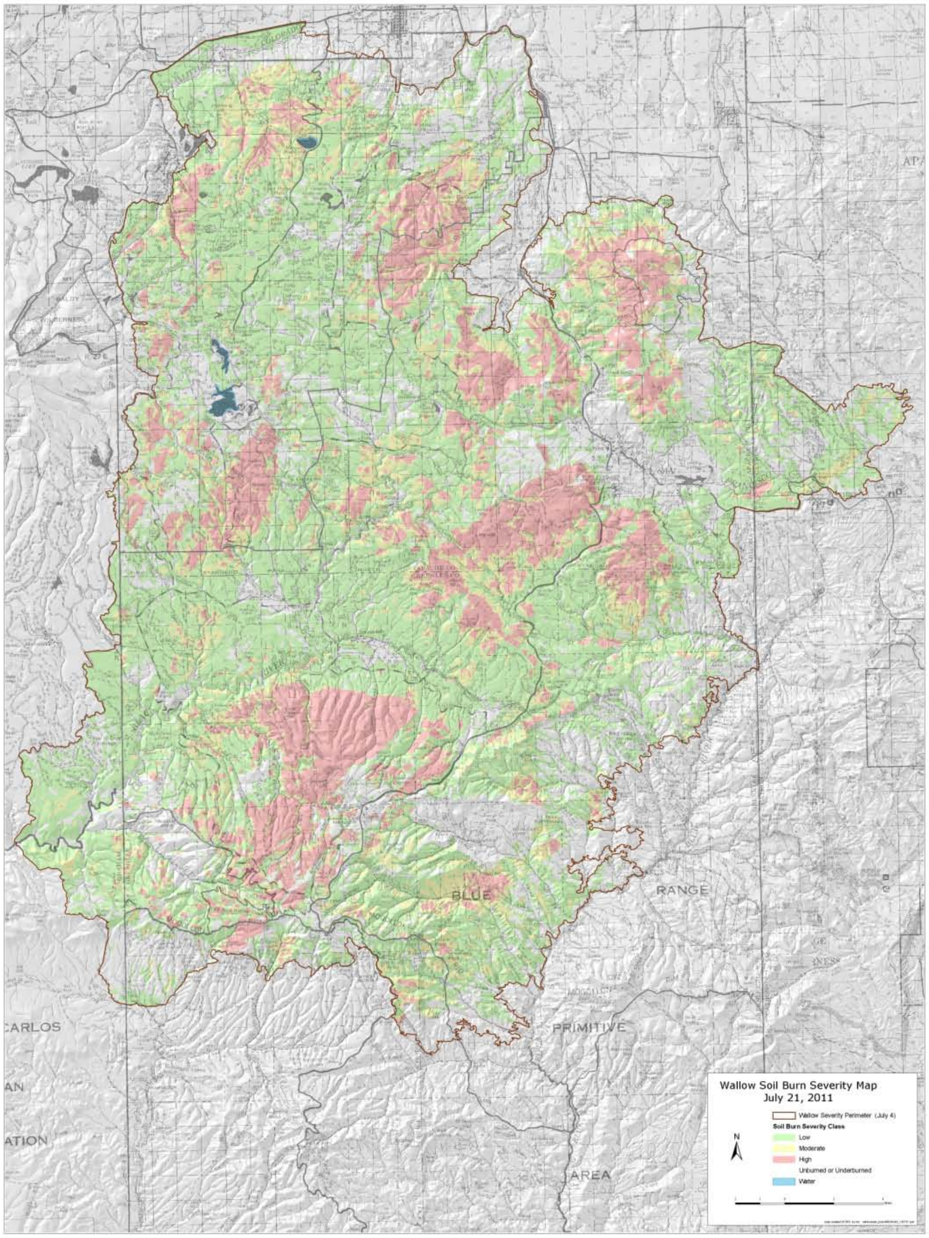
Acres of Fire Severity by Existing Vegetation type based on RAVG classification				
	0-25%	**25-50%**	**50-75%**	**75-100%**
	Unburned to low	**Low to moderate**	**Moderate to high**	**High**
Mixed Conifer	12,702	14,567	9,096	32,431
Ponderosa Pine	18,325	52,992	40,443	39,220
Total acres	31027	67559	49539	71651

Acres burned by existing vegetation type based on RAVG classification of basal area loss. Basal area loss includes grass, shrubs and tree cover types. The existing vegetation layer for this analysis was downloaded from www.landfire.gov and provides a grosser depiction of acres of each existing vegetation type than that used in the main Wallow Fire RAT Final Recovery Plan.

The RAVG process describes the loss in vegetation cover immediately after a wildfire when the analysis is performed (see map below). It does not describe a permanent loss in vegetation cover (http://www.fs.fed.us/postfirevegcondition/whatis.shtml, accessed 07/24/2011).



The Burned Area Reflectance Classification, or BARC, looks at the amount of reflectance from spectral bands for healthy green vegetation and rock and bare soil (see map below). The pre-burn image is compared to the post-burn image, and for areas with a high reflectance for bare soil and less for healthy green vegetation, these are classified as moderate and high burn severity (http://www.fs.fed.us/eng/rsac/baer/barc.html, accessed 07/24/2011).



The remainder of this report references the RAVG product anytime vegetation severity is referred to. The RAVG map product will continue to be updated and in fact, is scheduled for ground-truthing this coming September, 2011, so further analyses will have access to updated products.

Vegetation Response to Fire

The post-fire vegetative response and composition depends on several factors including fire severity, pre-fire vegetation, and species adaptations to fire (Brown et al 2003). Due to the sheer size of the Wallow Fire, numerous species, vegetation types and ecosystems were affected. This preliminary assessment highlights only a few of the tree species impacted.

Pinyon-Juniper

Pinyon pine and juniper trees are easily killed by fire, although one species of juniper, alligator juniper (Juniperus deppeanea), sprouts prolifically after fire. Apache-Sitgreaves National Forests personnel observed that the Wallow Fire did not spread in the pinyon-juniper type unless there was heavy dead and down fuels. Both pinyon and many species of juniper have low fire resistance from seedling to maturity based on bark thickness and inability to regenerate easily after disturbance (Brown et al 2000). A possible pathway of re-establishment from a post crown-fire pinyon-juniper stand to pinyon-juniper woodland may take up to 300 years (Brown et al. 2000) following a severe fire.

Ponderosa Pine

Ponderosa pine is adapted to frequent, low intensity surface fires, however a combination of crown consumption and crown scorch in moderate to high intensity fires can cause mortality in all size classes (Sieg et al 2006). Savage and Mast (2005) investigated trajectories of ponderosa pine stands following crown fire. At most sites they studied, ponderosa pine (PIPO) was the most abundant of any tree species following fire. They found a higher proportion of mixed conifer forest species, such as white fir and aspen occurring at higher elevation sites that regenerated to forest, while more Douglas-fir occurred at mid-elevation burn sites. Two general pathways of recovery emerged at their study sites in the decades after crown fire occurrence: 1—recovery to a PIPO forest, with densities exceeding the historic range of variation or 2) a deflection of forest recovery toward another vegetative state.

Aspen

Quaking aspen (Populus tremuloides) is very competitive on burned sites. It often dominates a site after fire even where it was barely noticeable as a component of the pre-fire vegetation. Aspen has adapted to fire in many ways, including easy top-kill by fire so root systems can send up a profusion of sprouts, and rapidly growing sprouts that extract the needed water, nutrients and photosynthate from the post-fire extant root system (FEIS 2011). Sudden Aspen Decline had been noted within the boundaries of the Wallow Fire prior to the burn. It is unknown yet whether this will effect aspen sprouting following the fire, however this situation warrants assessment and monitoring (please refer to Insect and Disease Report).

Moderate severity fire does not damage aspen roots. Severe fire may damage or kill shallow aspen roots, but deep roots are not damaged by fire and maintain the capacity to sprout (FEIS 2011). Severe fire may result in fewer sprouts than moderate severity fires; however, since aspen is self-thinning, post-fire sprouting densities between moderate and severe fires achieve similar numbers several years after the fire (FEIS 2011).

Douglas-Fir

From seedling to pole-sized, Douglas-fir (Pseudotsuga menziesii) has a low-branching habit and thin bark that make it very susceptible to fire damage. Crown scorch can kill Douglas-fir. The low branching habit encourages damage to the crown, which can outweigh the insulative nature of the bark. However, as they mature, the bark thickens, and survival of moderately severe fires is possible (FEIS 2011).

The ability of Douglas-fir to reestablish following the Wallow Fire will depend on a viable seed source and desirable growing conditions. There is some concern about the pre-burn presence of Douglas-fir beetle and Douglas-fir dwarf mistletoe that may now impact remaining seed trees (please refer to Insect and Disease Report). Douglas-fir seed germinates and establishes best on bare mineral soils, conditions provided by fire disturbance. Douglas-fir seedlings need partial shade while they are very young, but once established, require full sunlight (FEIS 2011). Regeneration success of Douglas-fir on the Wallow Fire will depend on available and surviving seed trees, good seed crops and accessible bare mineral seedbeds.

White Fir

White fir (Abies concolor var. concolor) is highly susceptible to fire damage as a young tree due to its thin bark, resin blisters on the bole and drooping lower branches. As a result, young trees are easily killed by even low intensity surface fires. As trees mature, the bark thickens and the older trees develop some degree of fire tolerance. Following fire, white fir reestablishes via wind- dispersed seed (FEIS 2011). White fir is an aggressive shade-tolerant tree that is able to reproduce successfully in the understory of ponderosa pine, Douglas-fir, and aspen stands.

Post-burn vegetation conditions/fire hazard

Potential fire intensity and severity have changed in all vegetation types impacted by the Wallow Fire. Predicted post-burn fire behavior is described here using the 40 Fire Behavior Fuel Models from Scott and Burgan (2005) and is based on current vegetation conditions as a result of burn severity and potential plant regeneration. This preliminary assessment of changes in fire hazard will focus on only two major cover types—mixed conifer and ponderosa pine, and the changes in fuel models used to describe fire behavior within each type.

Estimated fuel model changes in low, moderate and high severity areas are seen in the table below. A fuel model “is a set of fuelbed inputs needed by a particular fire behavior or fire effects model” (Scott and Burgan 2005) and is described by the primary carrier of the fire such as timber litter, timber understory, grass shrub, grass, shrubs or slash. In areas that experienced low fire intensity and severity during the Wallow Fire, such as the low severity areas in the ponderosa pine and the mixed conifer type (see photos below of the mixed conifer type), where surface fuel loading of needles was reduced and the lower branches on the overstory were killed and removed, future fire behavior will be mitigated by this reduction of fine fuels. Both surface fuel loading and crown fuels contribute to the risk of a crown fire. Surface fuels have been reduced and the average crown base height in the stand has been raised, so it is less likely for these areas to experience a crown fire due to torching trees. When a fire does occur in the area, the primary carrier of the fire will be needlecast and the new grass layer that is already growing (see figures below). The fire will be less intense, produce less heat, and consequently be less severe, translating to less overstory mortality and changed soil conditions.

In areas that experienced high severity fire effects, such as the mixed conifer sites on the Wallow Fire, most of the surface fuels and much of the fine fuels in the overstory tree canopy have been consumed (see figures below). Future fire intensity and severity will not be a concern in these areas until the stand regenerates and the overstory snags fall down and come in contact with the soil surface. When large logs ignite, they produce more heat for a longer time than smaller fuels. Future fire intensity in the mixed conifer sites will depend on the type and arrangement of the vegetation that becomes established. Potential fire intensity will be lower in areas where aspen becomes established and is the dominant understory. Because aspen does not readily ignite and burn, potential fire intensity and severity would be lower in the future. However, Apache-Sitgreaves National Forests staff observed that in areas with an overstory of aspen but a large amount of dead and down in the understory, then the aspen did burn.

Low severity fire effects in a mixed conifer forest on the Springerville Ranger District.

The needlecast and new grass layer will now be the primary carrier of future fires in low severity areas.

High severity fire effects in the mixed conifer forest on the Springerville Ranger District.

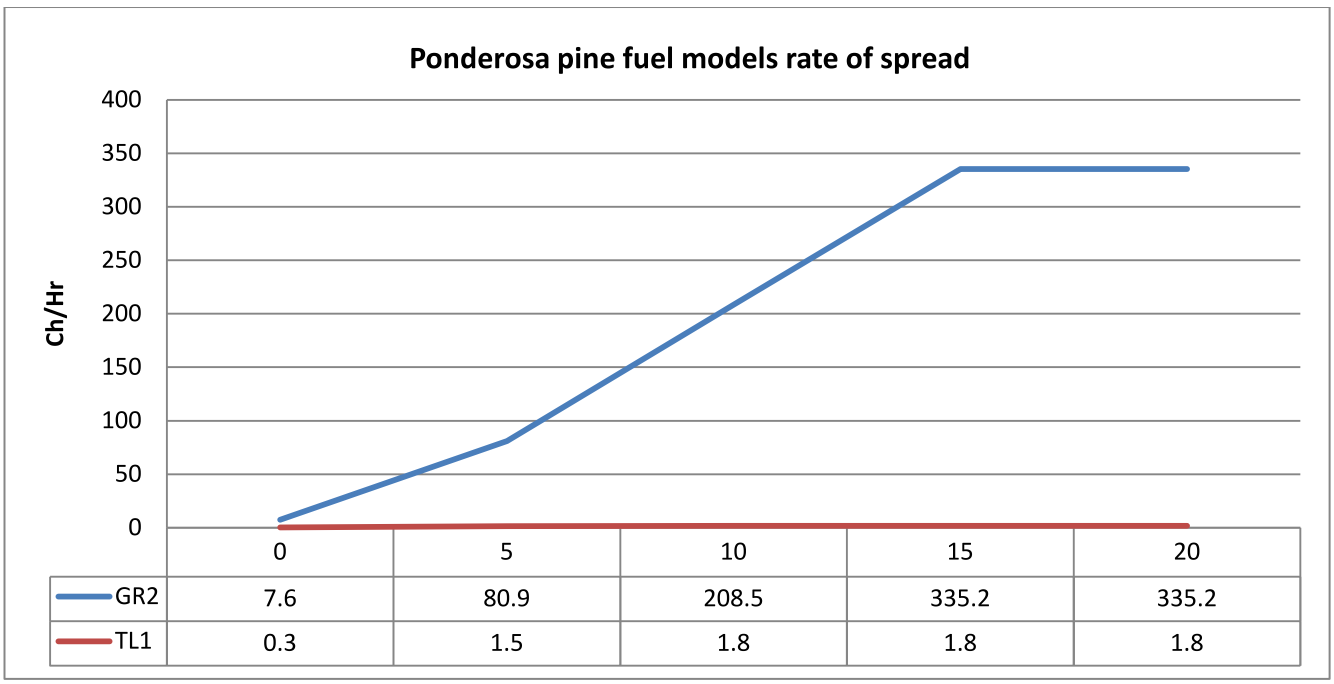
Fuel Model Changes Resulting from the Wallow Fire

Fuel models did not change appreciably in the areas experiencing low severity fires. In the ponderosa pine GR2—Low load, dry climate grass, the primary carrier of the fire is now timber litter/needlecast until the grass resprouts or reseeds (see table below). However, in the moderate to high severity areas, fuel conditions are now better described using fuel models that include large dead wood such as TL1—Low load, compact conifer litter. This fuel model, TL1, represents conditions where the main carrier of fire is compact litter, needlecast or large downed logs, in contrast to the pre-burn conditions where the primary carrier would have been grass.

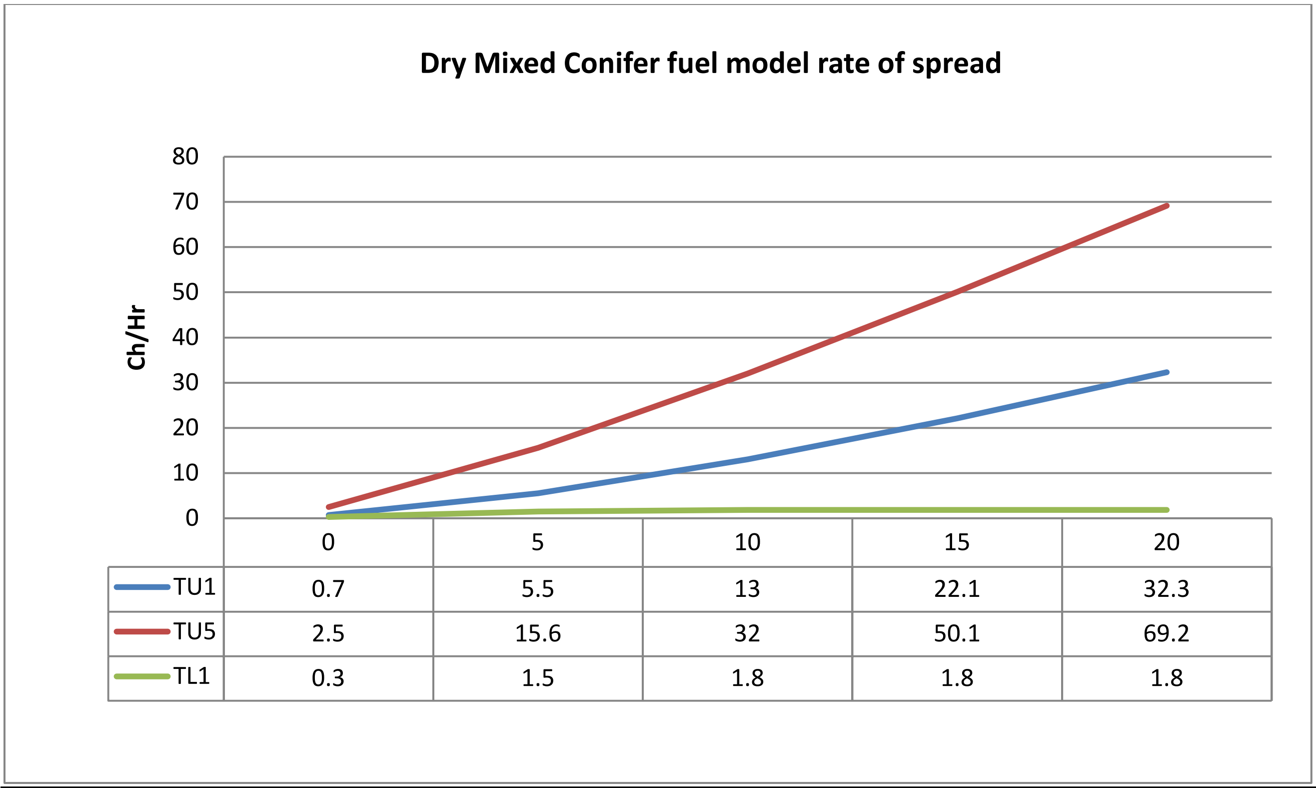
Fuel Type	Severity	Pre-Fire	Post-Fire
Mixed-Conifer	Low	TU1, TU5	TU1
	Moderate	TU1, TU5	TL1, TU1
	High	TU1, TU5	TL1
Ponderosa Pine	Low	GR2	GR2, TL1
	Moderate	GR2	TL1, GR2
	High	GR2	TL1

Pre and post-fire fuel models based on dominant overstory vegetation. Primary carrier of fire is: TU1, TU5—timber understory, TL1—timber litter, and GR2—grass.

Fire behavior of each fuel model listed is described (see figures below) by estimating rate of spread for the weather and fuel moisture conditions experienced at the height of the Wallow Fire on the Alpine and Springerville Ranger Districts.



Fuel model change in the ponderosa pine cover type from a pre-burn GR2-grass fuel model to a post-burn TL1-timber litter model result in much lower rates of spread at all predicted wind speeds.



	0	5	10	15	20
TU1	0.7	5.5	13	22.1	32.3
TU5	2.5	15.6	32	50.1	69.2
TL1	0.3	1.5	1.8	1.8	1.8

Fuel model change in the mixed conifer cover type from pre-burn TU1 and TU5-timber understory fuel models to a post-burn TL1-timber litter model result in much lower rates of spread at all predicted wind speeds.

Part 3—Recovery Objectives

Fuels hazard and fire behavior potential were at a critical stage in the pre-burn Wallow Fire area, as evidenced by the FRCC map at the beginning of this report. However, the burn has created a mosaic of fuels conditions, facilitating a change in fire behavior and mitigating risks to communities and values at risk. A specific change condition assessment of fuels and fire behavior is urgent and time-sensitive if the Forest is to produce a NEPA decision that will take advantage of the present fuels mosaic. A fuels change condition assessment will help determine priorities for treatment that will continue to protect values at risk from future wildfires, and allow for the flexibility of using planned and unplanned ignitions, capitalizing on the reduced hazard created by the fire and subsequent treatments.

Treatment Prioritization

Forest Fire Management Staff have expressed the need to continue fuels treatments, mechanical and prescribed burning, within the Wallow Fire Area to meet resource objectives in the Apache-Sitgreaves National Forests Management Plan. They feel the fire effects have provided some flexibility in how they will be able to apply unplanned and planned ignitions to meet resource objectives, particularly around communities and values at risk. The fire effects ranging from low to high severity in the fuels that were already considered hazardous pre-burn means that some areas of concern are now experiencing reduced fire hazard, while others in the low severity continue to present high fire hazard to values at risk. Having a wildfire in an area does not mean that fire hazard is greater or minimized; it is simply changed depending on pre-burn fuel conditions and fire severity.

Hazardous Fuels Priorities

- Maintenance in low/moderate severity to maintain fire effects, low crown fire hazard.
- Continuing Program of Work in low severity and unburned areas to manage hazardous fuels.
- Treat with planned and unplanned ignitions in high severity when large dead logs start to come down next 5-10 years. Any treatments around natural or artificial regeneration need to consider reforestation objectives, and time treatments accordingly. Mechanical treatments are also an option where it is necessary to treat hazardous fuels before establishing desired regeneration.
- Continue and plan for further treatments to prevent uncharacteristic crown fire hazard where it still exists within the Wallow Fire Perimeter.

Proposed Actions

Apache-Sitgreaves Forests Personnel have suggested repeatedly that the planning process for using prescribed fire to maintain fuels conditions and reduce hazardous fuels conditions be done as soon as possible, either concurrently or combined with other Wallow Fire planning. They recommend focusing treatments initially in the north and east areas of the Wallow Fire extent, upwind of communities at risk such as Springerville, Eager, Greer, Alpine, Luna and Nutrioso, as well as others. Other suggested areas for treatment consideration include around developed recreation sites and wilderness areas. Treating these fuels initially will facilitate the further use of planned and unplanned ignitions on the interior of the Wallow Fire extent. The Apache-Sitgreaves National Forests Land Management Plan already allows for the use of unplanned ignitions to meet multiple resource objectives. The post-burn fuel mosaic created by the Wallow Fire will aid in the ability to safely implement unplanned ignitions, meeting resource objectives while still protecting values at risk.

The fuels mosaic created by the Wallow Fire has given the Apache-Sitgreaves National Forests the opportunity to expand the use of unplanned ignitions around Communities and Values at Risk where fuels hazard and ability to meet resource objectives prior to the Wallow Fire made its use unlikely. Maintaining this fuels mosaic of low and moderate fire hazard is also imperative and points to the urgent need to assess, plan for and implement large-scale projects to facilitate the historic, frequent fire, low intensity fire regime in the ponderosa pine and dry mixed conifer types.

Current Forest Plan Direction for Fire Management

The current Apache-Sitgreaves National Forests Plan allows for the application of unplanned and planned ignitions to meet multiple resource objectives (see paragraph insert below), and subsequent project level planning is needed to implement planned ignitions within the Wallow Fire perimeter.

> **“Fire and Fuels Management**
>
> Fire is used as a resource management tool where it can effectively accomplish resource management objectives. Fire prevention and control are used to protect life, property, and resources (Apache-Sitgreaves National Forests Plan, 1987, as amended 2008, pg. 17).” “Low severity fires resulting from unplanned ignition may be properly classified as fire for resource benefits and allowed to burn as long as they meet Forest Plan objectives and do not endanger life, property, or resources (Apache-Sitgreaves National Forests Plan, 1987, pg. 88). “

• **Action** (*Activity or Treatment Name and ID# - as used in Table 4)*: 17-Wallow Fire Area Prescribed Fire Analysis—1 to 3 years	
1	Action Description: Conduct a NEPA analysis to authorize the implementation of prescribed fire on National Forest lands within the boundaries of the Wallow Fire.
2	Which resource or issue area(s) does it address? Wildlife, Fish, and Rare Plants, Forestland Vegetation, Rangeland Vegetation, Soil and Water, Hazardous Fuels
3	How does the action relate to damage or changes caused by the event? The Wallow Fire resulted in significant vegetation change over large areas of the Forest. In low severity areas, the fire removed fine dead fuels and raised the crown of the overstory trees, effectively reducing the hazard of a crown fire in these areas. While in high severity areas, large amounts of trees were killed. As these trees fall, they will change fire hazard over time as trees and shrubs regenerate around them. In addition, forage and browse that responded positively to the fire will experience a decline in vigor and palatability. In order to maintain the low fire hazard conditions in the low and moderate fire severity areas and anticipate changing fire hazard in the high severity areas, planning for planned ignitions to be resource objectives needs to be completed.
4	What are the consequence(s) of not implementing the action? Increased fuel loading and fire hazard, decreased forage and browse vigor and availability, departure from natural fire return intervals, and long-term decline in Forest Health. Essentially, a return to pre-Wallow Fire fuel conditions with greater fire severity potential due to large down and woody component in some areas.
5	What is the cost of the action? Why is the action reasonable, within policy, and cost effective? Table 4 shows $20,000 for FY12 and FY13 based on no permanent employee costs. The total cost of $200,000 reflects permanent and seasonal costs as well as vehicles, travel, per diem, supplies and printing costs for the portion of an environmental analysis that include fuels and forest health. Personnel costs ~ $160,000 for approximately 2 months each of a: NEPA team leader, Fuels Specialist/fire ecologist, silviculturist, wildlife biologist, fisheries biologist, GIS specialist, hydrologist, archaeologist, writer/editor, engineer, public affairs officer. Vehicles, travel, per diem, supplies, printing costs: $40,000. This NEPA analysis should be combined with any Reforestation/Salvage analysis in order to be ready to implement where and when appropriate.

• **Action** (*Activity or Treatment Name and ID# - as used in Table 4)*: 17-Fuels and fire behavior assessment—0 to 2 years.	
1	Action Description: Assessment of post-Wallow Fire fuel models and potential fire behavior.
2	Which resource or issue area(s) does it address? Life, health, and safety/ Forestland Vegetation/Rangeland Vegetation/ Soil and Water/Invasive Species/Forest Insect or Disease/Infrastructure/Wildlife, Fish and Rare Plants/Heritage/Hazardous Fuels. Will assist in the Wallow Fire Area Prescribed Fire Analysis by helping to prioritize areas needing treatment first, such as in the north and east of the Wallow Fire perimeter closer to communities and values at risk, including but not limited to high value developed recreation sites.
3	How does the action relate to damage or changes caused by the event? The changes in pre- and post-burn vegetation conditions mean a changed condition over 538,000 acres relating to fire behavior. It is necessary to determine present and future fire behavior in order to determine efficacy of proposed treatments, while continuing to protect values and communities at risk within and around the Wallow Fire. Utilizing pre-burn satellite imagery, estimating post-burn vegetation condition and burn severity, fire behavior models will be used to predict immediate and long-term fire behavior and subsequent hazard to values and communities at risk.
4	What are the consequence(s) of not implementing the action? Unknown fire hazard and fire behavior.
5	What is the cost of the action? Why is the action reasonable, within policy, and cost effective? Table 4 reflects a total of $2500 that only includes vehicles, travel/per diem and supplies. The total cost of $16,000 includes permanent costs as well as vehicles, travel/per diem and supplies. 1 GS-11 Fuels Specialist @ 3 weeks ~ $4500 1 GS-12 Fuels Specialist @ 3 weeks ~ $6000 1 GS-11 GIS Specialist @ 2 weeks ~ $3000 Vehicles, Travel/per diem, supplies ~ $2500
Action (Activity or Treatment Name and ID# - as used in Table 4): 17-Burn Severity Classification and Ground-truthing—0 to 2 years. This project has been combined with a Digital Imagery Flight to take place in September, 2011, so costs removed from Table 4.	
1	Action Description: Ground-truth burn severity mapping.
2	Which resource or issue area(s) does it address? All resource areas.
3	How does the action relate to damage or changes caused by the event? Multiple projects and administrative actions to be implemented within the Wallow Fire, including re-opening of recreation sites, range allotments, roads, reforestation, invasive weed control, etc…..depend on accurate burn severity classification. Fortunately, immediate post-burn severity imagery is available with the BARC and RAVG images. Both of these efforts will be utilized to assess and update burn severity. On-the-ground verification of burn severity will be completed with a process called Composite Burn Index (CBI), a verification of burn severity that offers higher resolution in describing severity over a longer term (http://www.nrmsc.usgs.gov/science/fire/cbi/description, accessed 07/25/2011). CBI

	combines five strata into one index, classifying burn severity using substrate and vegetation according to height or layer.
4	What are the consequence(s) of not implementing the action? Due to the extent of the Wallow Fire, preliminary severity mapping provides for emergency and short-term planning and implementation, however long-term planning such as public health and safety, reforestation and salvage relies on more specific severity mapping.
5	What is the cost of the action? Why is the action reasonable, within policy, and cost effective? Costs removed from Table 4. $12,000 2 GS-05's fuels techs @ 1 month ~ $4800 1 GS-07 crew leader @ 1 month ~ $2600 1 GS-11 GIS specialist @ 2 weeks ~ $3000 Vehicle, supplies, camera ~ $1600
Action (*Activity or Treatment Name and ID# - as used in Table 4)*: 17—Low severity fire hazard maintenance—1 to 3 years and 3 to 10 years.	
1.	Action Description: Maintenance of low severity and moderate severity fire hazard in ponderosa pine and mixed conifer cover types.
2.	Which resource or issue area(s) does it address? Life, Health, and Safety/ Forestland Vegetation/Rangeland Vegetation/Soil and Water/Invasive Species/ Wildlife, Fish, and Rare Plants/ Heritage/ Hazardous Fuels.
3.	How does the action relate to damage or changes caused by the event? Goal of treatments is to maintain fuels conditions in ponderosa pine and dry mixed conifer types at levels that will perpetuate low intensity, surface fires. This meets multiple recovery objectives as well as pre-burn resource objectives.
4.	What are the consequence(s) of not implementing the action? Fuel conditions will return to pre-burn hazard, threatening resource objectives and values at risk.
5.	What is the cost of the action? Why is the action reasonable, within policy, and cost effective? Approximately 100,000 acres are in the low to low-moderate burn category as classified by the RAVG process. Maintaining these acres on a fire return interval within the historic range of variability and maintaining a low fuel loading requires treating approximately 5,000 acres/year. Planning for these treatments will take place in the 17-Wallow Fire Area Prescribed Fire Analysis. Cost to implement /acre ~ $150 @ = $750,000 Partnership potential: Rocky Mountain Elk Foundation, Mule Deer Federation, Dedicated Sportsmen, and other non-profit groups involved in stewardship.
• **Action** (*Activity or Treatment Name and ID# - as used in Table 4)*: 17-Natural and Artificial regeneration hazard reduction—3-10 years	
1.	Action Description: Use planned and unplanned ignitions to treat large, woody debris in high severity areas to protect natural regeneration and artificial regeneration. Mechanical fuels reduction methods should also be considered, such as mastication or crushing.
2.	Which resource or issue area(s) does it address? Forestland Vegetation/Soil and Water/Invasive Species/Wildlife, Fish and Rare Plants, Hazardous Fuels.

3.	How does the action relate to damage or changes caused by the event? High burn severity areas in the tree cover types have a large amount of standing, dead trees that will fall within the next 5 to 10 years, if not sooner. As these areas begin to regenerate in tree species, and are planted for reforestation needs, the downed logs will present a hazard to the young regeneration if a fire were to move through the area. Although it will still be difficult for fire to spread, heat from these burning logs will cause mortality in adjacent regeneration. The windows of opportunity for these treatments in the near future will depend on both reforestation and fuels hazard mitigation objectives.
4.	What are the consequence(s) of not implementing the action? As the large logs fall to the ground, and as the regeneration matures around them, a fire in the large, dead woody material will cause mortality in the regrowth.
5.	What is the cost of the action? Why is the action reasonable, within policy, and cost effective? Planning for these treatments will take place in the 17-Wallow Fire Area Prescribed Fire Analysis. Cost to implement /acre ~ $200 @ 5,000 = $1,000,000 annually.
• **Action** (*Activity or Treatment Name and ID# - as used in Table 4)*: 17-Wallow Fire Area Fuels Treatment Effectiveness Public Outreach Driving Tour—1 to 3 years	
1	Action Description: Design public driving tour for passenger vehicle and ATV highlighting fuels treatment effectiveness around communities and values at risk.
2	Which resource or issue area(s) does it address? Life, Health and Safety, Hazardous Fuels, Public Outreach and Education.
3	How does the action relate to damage or changes caused by the event? Many Wildland Urban Interface areas were treated prior to the fire and need to be highlighted for success or failure to instill Lessons Learned for agency employees and for private landowners within WUI.
4	What are the consequence(s) of not implementing the action? The public will continue to question the need to treat next to private property, which is a healthy debate. However, first-hand knowledge will go far to inform the debate.
5	What is the cost of the action? Why is the action reasonable, within policy, and cost effective? Table 4 shows a total cost of $8000 which includes Writer/Editor Contractor, Field Technician and supplies. The total estimated cost includes permanent time also and = $12,500. Personnel costs ~ Public Affairs Officer @ $1500/week for 3 weeks = $4500 Writer/Editor (Contractor) @ $1000/week for 1 week = $1000 Field technician for photography/sign installation = $2000 Supplies (signs, brochures) = $5000

PART 7 – SKILLS AND STAFFING NEEDS

Instructions: Identify needs above and beyond those that can be provided by the existing organization

Skills and Staffing Needs for Planning and Change Condition Assessments in Hazardous Fuels (17)				
Job Title	Series/Grade	# of Positions Needed	Payperiods Needed	Timeframe Needed
NEPA team leader	GS-13	1	12	2012/2013
Fuels Specialist/Fire Ecol	GS-11/12	1	15	2011/2012/2013
Fuels Specialist	GS-11	1	3	2012
Silviculturist	GS-11	1	12	2012/2013
Wildlife Biologist	GS-11/12	1	12	2012/2013
Fisheries Biologist	GS-11/12	1	12	2012/2013
GIS specialist	GS-11	1	16	2012/2013
Hydrologist	GS-11/12	1	12	2012/2013
Archaeologist	GS-11/12	1	12	2012/2013
Writer/Editor	GS-9/11	1	12	2012/2013
Engineer	GS-11/12	1	12	2012/2013
Public Affairs Officer	GS-11/12	1	12	2012/2013
Fuels Technician	GS-05	2	2	2011/2012
Fuels Crew Leader	GS-07	1	2	2011/2012

Literature cited

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PART 5 – MONITORING AND RESEARCH OPPORTUNITIES

These research opportunities are not included in Table 4 but have been suggested by Rocky Mountain Research Station personnel and USFS Region 3 Fire and Aviation Management staff.

• Action (*Title and # of monitoring and research activity):* 17-Fuels Treatment Effectiveness Research	
1.	Action Description: Examine effectiveness and longevity of fuels treatments implemented for hazard reduction within and adjacent to Wildland Urban Interface.
2.	How will the activity provide essential information related to damage or changes caused by the event? Hazardous fuels treatments completed in the area need to be rigorously examined for impacts on fire behavior and protection of values at risk. Preliminary immediate post-burn reports indicate fuels treatments worked very well where the objectives were to change fire behavior to protect values at risk. Disclosure of these successes to the public at a time of heightened interest will aid in further treatments within the Wallow Fire Area. It is also very important to highlight the specific objectives of the fuels treatments, whether for fuels hazard reduction, forest restoration or a combination, as well as the location of the treatments. A closer examination of these treatments will also lead to more efficient application concerning location, size, and cost of treatments, as well as an understanding of the temporal nature of the treatment. Specifically, were they effective due to recently being implemented?
3.	What are the consequence(s) of not implementing the activity? Examining the reasons for the success or failure of fuels treatments will lead to more useful future applications. Continuing to apply the same treatments without investigating their usefulness will lead to loss of dollars and resource values, and most importantly, increase hazard to communities and values at risk.
4.	What is the cost of the activity? What is the source of funding? Costs: 2 GS-05 fuels technicians--field verification @ ~ $2400/month/ea for 2 months = $4800 1 GS-07 fuels technician @ ~ $2600/month/ea for 2 months - $5200 1 GS-11 GIS specialist @ ~ $6000/month/ea for 1 month = $6000 1 GS-12 Research scientist @ ~ $8000/month/ea for 2 months = $16,000 1 GS-12 Fuels Specialist @ ~ $8000/months/ea for 1 month = $8000 Vehicles, supplies, travel/per diem = $8000.00 Total cost = $48,000. Potential funding opportunities include the Joint Fire Science Program and the Southwest Fire Science Consortium.
5.	Who will carry out the activity? Potentially implemented by Rocky Mountain Research Station, USDA Forest Service, and/or additional interested Research stations as well as Academic Institutions such as Northern Arizona University, and the Ecological Restoration Institute.

• Action (*Title and # of monitoring and research activity):* 17-Testing field guidelines for identifying trees that will die	
1.	Action Description: Guidelines have been developed for field crews to quickly assess, with high probability, whether a fire-damaged tree is likely to die using just two characteristics: crown scorch and crown consumption. The Wallow Fire provides multiple opportunities to

	test these guidelines across a range of fire severities.
2.	How will the activity provide essential information related to damage or changes caused by the event? Providing a quick tool to accurately predict the probability of tree mortality following a fire will lead to better decisions that are defendable in court. The test would involve permanently marking a number of trees (~500) on the wildfire, measuring crown damage variables, and following survivability for three years.
3.	What are the consequence(s) of not implementing the activity? Unnecessary time and money will continue to be spent and personnel exposure to undue risk will continue while cutting trees down that are deemed hazard trees but in fact may not die. These trees may also be valuable sources of seed for the next generation, but will not be seed producers once cut down.
4.	What is the cost of the activity? What is the source of funding? *Describe how the activity is cost-effective, why is the activity worth the investment?* Costs: 2 GS-05 fuels technicians--field verification @ ~ $2400/month/ea for 2 months = $4800 1 GS-07 fuels technician @ ~ $2600/month/ea for 2 months - $5200 1 GS-12 Research scientist @ ~ $8000/month/ea for 2 months = $16,000 1 Graduate Level Student funded through research grants and University dollars. Vehicles, supplies, travel/per diem = $8000.00 Total cost = $34,000. Potential funding opportunities include the Joint Fire Science Program and the Southwest Fire Science Consortium.
5.	Who will carry out the activity? *Identify responsible parties and collaborations/partnerships needed to carry out the activity.* USDA Forest Service Research Stations, academic institutions.
•	Action (*Title and # of monitoring and research activity):* 17-Effectiveness of seeding and mulching
1.	Action Description: *Describe the type (e.g. monitoring, administrative study, research) and general purpose of the proposed activity. Include information on where is the activity proposed and what land base or restrictions are required to successfully implement.* This research would involve quantifying the effectiveness of seeding/mulching in enhancing plant cover and reducing non-native invasive plants. The research would also examine reburn potential by measuring fuel loadings and stand structure in treated and untreated areas. The goal would be to establish as 5-8 pairs of treated and untreated plots that are as similar as possible, so that differences due to treatments could be isolated.
2.	How will the activity provide essential information related to damage or changes caused by the event? The goal of this research activity is to examine the effectiveness of seeding and mulching during Burned Area Emergency Rehabilitation projects. Activities immediately following wildfires in the southwest are done to protect life, health and safety. While short-term impacts are dealt with by seeding and mulching unstable slopes, the long-term impacts of fine fuel loading produced need to be examined in light of future fire behavior.
3.	What are the consequence(s) of not implementing the activity? The consequences of not implementing the research are that our actions may be producing fuel loadings that will prevent potentially hazardous fire behavior in the long-term.

4.	What is the cost of the activity? What is the source of funding? Costs: 2 GS-05 fuels technicians--field verification @ ~ $2400/month/ea for 2 months = $4800 1 GS-07 fuels technician @ ~ $2600/month/ea for 2 months - $5200 1 GS-12 Research scientist @ ~ $8000/month/ea for 2 months = $16,000 1 Graduate Level Student funded through research grants and University dollars. Vehicles, supplies, travel/per diem = $8000.00 Total cost = $34,000. Potential funding opportunities include the Joint Fire Science Program and the Southwest Fire Science Consortium.
5.	Who will carry out the activity? *Identify responsible parties and collaborations/partnerships needed to carry out the activity.* USDA Forest Service Research Stations, academic institutions.
• Action (*Title and # of monitoring and research activity):* 17-Effects of a wildfire on large trees and fuel beds	
1.	Action Description: *Describe the type (e.g. monitoring, administrative study, research) and general purpose of the proposed activity. Include information on where is the activity proposed and what land base or restrictions are required to successfully implement.* We propose re-sampling plots we established in 2005 in areas with large ponderosa pine trees with deep forest floor layers. Our goal would be to examine the effect of the fire on cambial damage, tree mortality, and fuel bed attributes.
2.	How will the activity provide essential information related to damage or changes caused by the event? It is often suggested that large trees need to be raked around before prescribed burning so that the duff and litter layer does not burn, causing girdling-mortality to the tree. Plots established in 2005 to examine this question under a prescribed burn scenario can now be remeasured for a wildfire situation, informing the question of duff and litter layer contribution to tree mortality following a wildfire.
3.	What are the consequence(s) of not implementing the activity? A lost opportunity to re measure permanent plots that will answer a question that may provide a lot of expense and time-lost for field crews when they have to rake around trees before prescribed burning.
4.	What is the cost of the activity? What is the source of funding? Costs: 2 GS-05 fuels technicians--field verification @ ~ $2400/month/ea for 2 weeks = $2400 1 GS-07 fuels technician @ ~ $2600/month/ea for 1 month - $2600 1 GS-12 Research scientist @ ~ $8000/month/ea for 1 months = $8,000 1 Graduate Level Student funded through research grants and University dollars. Vehicles, supplies, travel/per diem = $4000.00 Total cost = $17,000. Potential funding opportunities include the Joint Fire Science Program and the Southwest Fire Science Consortium.
5.	Who will carry out the activity? USDA Forest Service Rocky Mountain Research Station, Region 3 Fire and Aviation Management.
• Action (*Title and # of monitoring and research activity):* 17--Will forest composition along lower and upper ecotones change following a wildfire?	

1.	Action Description: Recent literature has suggested that more drought-tolerant species may regenerate following large disturbances such as wildfires. For example, at low elevation ponderosa pine ecotones, juniper may regenerate more successfully, and at low elevational mixed conifer stands, ponderosa pine may regenerate more successfully. We propose to establish permanent transects across elevational gradients at low and high elevation ecotones and quantify tree regeneration by species.
2.	How will the activity provide essential information related to damage or changes caused by the event? Providing information along ecotonal changes and varying burn severities for restoration teams about possible vegetation recovery trajectories will aid in reforestation and hazardous fuel planning.
3.	What are the consequence(s) of not implementing the activity? Restoration efforts may suggest planting species where they will not be successful, leading to the loss of dollars and time spent.
4.	What is the cost of the activity? What is the source of funding? Costs: 4 GS-05 fuels technicians--field verification @ ~ $2400/month/ea for 2 months ea = 8 months @ $19200.00. 1 GS-07 fuels technician @ ~ $2600/month/ea for 2 months - $5200.00 1 GS-12 Research scientist @ ~ $8000/month/ea for 2 months = $16,000 1 Graduate Level Student funded through research grants and University dollars. Vehicles, supplies, travel/per diem = $8000.00 Total cost = $48400. Potential funding opportunities include the Joint Fire Science Program and the Southwest Fire Science Consortium.
5.	Who will carry out the activity? USDA Forest Service Research Stations, Academic Institutions.