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National Forest

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# Station Fire BAER Revisit



**Big Tujunga Dam  
Overlook**



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June 14, 2010

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## Executive Summary

The major finding for the Revisit is that although vegetative recovery is occurring, the Team expects that watershed response could be as great the second winter (2010/11) as the first. The threats and potential consequences from debris flows, flooding and rockfall will continue. This is based upon Dr. Sue Cannon's debris flow model predictions and observations she made during the first winter as well as observations by watershed specialists during the Revisit. Distinct rill networks have formed that will concentrate runoff quickly and sediment is still in place in channels that can be mobilized. The winter of 2009/10 was a relatively normal winter in regard to precipitation amounts and intensities and yet generated significant erosion, flooding and debris flows.

Vegetative recovery is quite visible, but the level of recovery is variable across the burn area. Generally at the time of the Revisit (early May 2010) low elevations in the front country were re-vegetating rapidly compared to very low levels at high elevations, which recently had snow cover. A low level was also noted on the north side of the fire which normally receives lower precipitation than the front country. The wide variability in vegetative recovery rates was evident from the Normalized Difference Vegetation Index (NDVI) analysis performed by Jess Clark of the Remote Sensing Applications Center and field observations made during the Revisit.

The Team recommends the Forest renew interagency coordination begun during BAER Assessment, especially with the NRCS, Los Angeles County, CalTrans and the National Weather Service in preparation for the coming winter. It is highly recommended the Forest contact the National Service Weather soon to determine if they would like to site more real-time reporting weather stations on NFS lands that would be operated and maintained by the National Weather Service (or other agencies) to further facilitate their storm warning forecasting.

Forest administrative sites and roads are still at risk during the coming winter. Previously approved BAER treatments to protect administrative sites should be reviewed and maintained. BAER road treatments for drainage control need to be reviewed and maintained. Road storm patrol should be continued and may need to be extended to more Forest roads.

The Team recommends that administrative area closure should be continued for the majority of the burn area. There are still risks to human life and safety from rock fall, debris flows, and flooding plus the burned lands need to be protected from disturbance so recovery can proceed. If temporary openings are considered, the Forest should focus on locations that are near primary roadways which will not require opening secondary forest roads. Only temporary, summer openings should be considered to reduce risk to human life and safety during the normal winter precipitation season. Summer thunderstorms are a possibility, however. An interdisciplinary team approach should be used to evaluate the potential threats and risks to human life, safety and natural and cultural resources in any areas proposed for temporary opening. The cost of planning and reopening recreation facilities must be paid for with funds other than BAER.

The Forest needs to complete implementation of BAER treatments that were delayed due to access problems from storm damage to roads, such as the mine opening closures (human life/safety), micro-trash removal (condor protection) and trail winterization work. Trails should be reviewed and water control measures implemented before the winter to prevent damage to the facility and prevent water concentration on slopes below the trails. It must be emphasized that the appropriate use for BAER funds is for protection (winterization) of only those trails which have original tread remaining or in other words, a residual value worth protecting. Where trails need complete reconstruction, other program funds should be used as part of long term rehabilitation and restoration. Hazmat sites that were stabilized may need retreatment if permanent hazmat cleanup will not be completed before the coming winter.

Regarding long term rehabilitation and restoration – The Team recommends the Forest consider the risk of potentially reoccurring threats to existing administrative sites due to future post-fire response. The same threats of debris flows and flooding may occur again and again after future fires near the same admin sites, such as Monte Cristo, where soils are highly erosive. The siting of new construction needs to consider slope position and the vulnerability of structures to these post-fire threats. Much can be learned about the vulnerability of existing admin sites by the watershed response observed this first winter.

Noxious weeds were present before the fire and have a great potential to spread because of bare soil conditions following the fire. A comprehensive noxious weed control program, including the use of herbicides for more effective control needs to be developed.

The continuing need for debris disposal should receive greater attention to limit resource damage/impact from waste disposal locations.

## Table of Contents

<b>Executive Summary</b> .....	<b>i</b>
<b>Team Report</b> .....	<b>1</b>
Revisit Objectives .....	1
Background - September 2009 BAER Assessment .....	1
Revisit Agenda - May 10-14, 2010.....	2
<b>Findings - BAER Team Predictions versus What Happened Winter 2009/2010</b> .....	<b>5</b>
<b>Findings - Resource Specialist Group Reports</b> .....	<b>7</b>
Botany and Invasive Species.....	7
Geology.....	8
Soils.....	9
Hydrology .....	11
Wildlife and Fisheries .....	11
Engineering (Roads).....	13
Non-Motorized Trails .....	14
Heritage .....	16
Hazardous Materials.....	17
GIS Considerations for Large Fires.....	18
<b>Recommendations</b> .....	<b>21</b>
Recommendations to prepare for 2010/11 winter .....	21
Recommendations after the Team Reviewed Initial 2500-8.....	22
Long Term Rehabilitation and Restoration Recommendations .....	24
Recommendations for Future BAER Assessments of Large, Complex Fires.....	24
<b>Appendix 1: After Action Review Station Fire Assessment</b> .....	<b>29</b>
What can be improved and <i>suggestions for future incidents</i> .....	29
Worked well .....	30
<b>Appendix 2: Station Fire BAER Implementation – Lessons Learned</b> .....	<b>31</b>
<b>Appendix 3: Participants - Station Fire BAER Revisit</b> .....	<b>33</b>

**Appendix 4: Resource Specialist Reports.....35**

Resource: Botany and Invasive Species Report..... 35

Resource: Engineering (Roads)..... 38

Resource: Geology..... 40

Resource: Soils..... 45

Resource: Hydrology ..... 48

Resource: Wildlife and Fisheries ..... 50

Resource: Non-Motorized Trails – Recreation and Watershed ..... 55

Resource: Heritage ..... 58

Hazardous Materials..... 61

GIS Considerations for Large Fires..... 64

## Team Report

### Revisit Objectives

During the Burned Area Emergency Response (BAER) Assessment of the Station Fire in September 2009 it was a common remark by Team members that they wanted the opportunity to return to the fire area following the first winter to compare their predictions to what happened. From May 10 until May 14, 2010 a Revisit was held to accomplish the following general Objectives.

1. Provide the original Assessment Team Members with a learning opportunity to compare their predictions and expectations made in September 2009 with what happened during the first winter.
2. Provide the opportunity for the Team to provide recommendations to the Forest on what to do to prepare for the second winter (2010-2011) following the fire.
3. Provide the Assessment Team with feedback from the Station Fire Implementation Team.
4. Provide an opportunity for the Assessment Team to provide general recommendations to the Forest regarding long term rehabilitation and restoration of the fire area.

### Background - September 2009 BAER Assessment

The Station Fire burned a total of 161,189 acres of which 154,431 (96%) were on the Angeles National Forest and 6,758 (4%) were on non-forest lands. It occurred within the San Gabriel Mountains in the Transverse Range of California, Los Angeles County, California. Approximately 16,678 acres (10%) were within the Pleasant View and San Gabriel Wilderness areas. The Burned Area Emergency Response (BAER) Assessment team evaluated Soil Burn Severity for both the National Forest System (NFS) lands as well as the private lands utilizing Burned Area Reflectance Classification (BARC) satellite data provided by the U.S. Forest Service Remote Sensing Applications Center with further ground checking. Approximately 73 percent of the entire burn was mapped as having a moderate and high soil burn severity (62% moderate and 11% high). The remaining 27% was either Low Soil Burn Severity or unburned.

A complete description of the Station Fire BAER Assessment can be found in the Initial 2500-8, completed September 2009 and the Specialist reports. The table below summarizes the findings of the assessment as background for the Revisit.

#### Summary of Critical Values and Resources

Value Category	Hazard	At Risk	Emergency Yes/No
Life & Safety	Increased runoff and debris flows, rock and debris fall, erosion and sedimentation, and landslides.	Users of National Forest roads, trails, campgrounds and administration sites; users of major county and state roads, public use of roads, trails, campgrounds, and facilities and homes on non-federal land both within and outside the Station Fire perimeter.	Yes
Property	Increased runoff and debris flows, rock and debris fall, erosion and sedimentation, and landslides. Increased threat of vandalism related to loss of vegetation.	Forest Service roads and trails, recreation infrastructure (i.e. campgrounds) and recreation residences in some locations, Forest Service fire stations and work centers, spring developments that provide critical water source for wildlife. Private homes, reservoirs, and facilities within and outside of the National Forest. State and County roads, highways, utilities, and infrastructure.	Yes

Value Category	Hazard	At Risk	Emergency Yes/No
Water Quality	Increase in sediment and ash delivered to the facility.	Water supply for the City of Palmdale is located in the Little Rock watershed at Little Rock Reservoir.	No
	Burned guard station debris and hazardous materials from illegal plantations.	Beneficial use of water.	Yes
Soil Productivity	Increased runoff and debris flows, rock and debris fall, erosion and sedimentation, and landslides.	There is no emergency to soil productivity due to fire-adapted ecosystems.	No
Heritage Resources	Looting and vandalism due to exposure and stability due to minor slope wash potential.	Integrity of Heritage sites.	Yes
Plant Communities	Loss of habitat and landscape biodiversity.	Rare plant species.	Yes
Ecosystem Structure and Function	Post-fire weed introduction and spread.	Natural vegetative recovery, watershed integrity and soil stability.	Yes
Wildlife & Fisheries Resources	Increased scouring and debris flows resulting in changes to channel morphology, lowered water quality, and erosion of streambanks and associated riparian vegetation. Dispersal and increased competition with non-native fauna. Ingestion of microtrash.	Designated Critical Habitat for: California condor (federally-endangered) Santa Anna sucker (federally-threatened) Mountain yellow-legged frog (federally-endangered) Least Bell's vireo (federally-endangered) Unarmored threespine stickleback (federally-endangered) Arroyo toad (federally-endangered) California red-legged frog	Yes

### Revisit Agenda: May 10-14, 2010

- **Monday:**
  - Jody Noiron, Forest Supervisor, welcomed the Team and provided desired priorities and emphasis items for the week. Brent Roath, Regional Soil Scientist/BAER Coordinator and Todd Ellsworth, Revisit Facilitator, lined out expectations for Team and Resource Groups.
  - Discussion and logistics for Tuesdays group field trip
  - Presentation by Pete Wohelgmuth, Hydrologist, PSW-Riverside, on first winter peak flow studies, sediment delivery and model validation.
  - Evening presentation by Dr. Sue Cannon, USGS, on debris flow predictions for the first winter and expectations for next winter.
- **Tuesday: Entire BAER Team Field Trip**
  - 8-9 AM Office - Presentation by Jess Clark, Remote Sensing Applications Center, on NDVI analysis (Normalized Difference Vegetation Index) of vegetative recovery for the Station fire.
  - Team field trip
  - Stop 1 – Delta Flat
  - Stop 2 – Vogel Flats
  - Stop 3 – Overlook of Big Tujunga Dam

- Stop 4 – Monte Cristo Station
- Stop 5 – Shooting area lead contamination and stabilization
- Stop 6 – Mill Creek Station
- **Wednesday:**
  - Individual Resource groups in the field
- **Thursday:**
  - Resource Group findings presentation
  - Implementation Lessons Learned
  - Recommendations to prepare for 2010/2011 winter
  - Work on specialists' reports, Team report, and line-officer briefing Power Point.
- **Friday:**
  - Line – Officer Closeout



## Findings - BAER Team Predictions versus What Happened Winter 2009/2010

Probably the most significant concern identified during the Station Fire BAER Assessment in September 2009 was the increased threat of debris flows and flooding. The following text was copied from the Initial 2500-8, Part V – Summary of Analysis, Summary of Watershed Response.

The most dramatic geologic hazard response to the fire will be the increase in destructive debris flows which bring sideslope and channel deposits racing down channel bottoms in a slurry similar to the consistency of concrete, in masses from a few hundred cubic yards to hundreds of thousands of cubic yards of saturated material, destroying everything in its path until it finally loses its momentum or is caught in a debris catchment basin. An emergency assessment of post-fire debris flow hazards for the Station Fire by the U.S. Geological Survey concluded that the Combined Relative Debris-Flow Hazard Rankings calculated in response to the 3-hour-duration storm were either "high" or "severe" for all but 18 of the 678 basins evaluated within the burned area. The 12-hour-duration storm resulted in either "moderately high", "high", or "severe" rankings for all but 25 of the basins. The large number of basins with "high" or "severe" rankings that drain into Big Tujunga Canyon, Pacoima Canyon, Arroyo Seco, West Fork of the San Gabriel River, and Devils Canyon indicates the potential for significant debris-flow impact both in these drainages and well downstream from the burned area. The USGS report concludes that "when compared with similar evaluations for past fires, this is the greatest number of basins we have seen with such high [debris-flow] probabilities."

The major finding for the Revisit is that although vegetative recovery is occurring, the Team expects that watershed response could be as great the second winter (2010/11) as the first. The threats and potential consequences from debris flows, flooding and rockfall will continue. This is based upon Dr. Sue Cannon's debris flow model predictions and observations she made during the first winter as well as observations of watershed specialists during the Revisit. Very distinct rill networks have formed that will concentrate runoff more quickly and sediment is still in place in channels that can be mobilized. The winter of 2009/10 was a normal winter in regard to precipitation levels and intensities and yet generated significant erosion, flooding and debris flows. The San Gabriel mountain range is historically known for exceptionally intense rainfall events. Vegetative recovery is quite visible, but the level of recovery is variable across the burn due to elevation, aspect, bedrock, soil type, and normal precipitation patterns and gradients from the front country to the northerly desert side of the burn. This finding was made evident by Revisit field observations and the Normalized Digital Vegetative Index (NDVI) analysis performed by Jess Clark of the Remote Sensing Applications Center.

On Monday May 10, Dr. Sue Cannon (US Geological Survey) gave a presentation to the Team. The following are key points from her PowerPoint.

1. The 2009-2010 winter precipitation events would be considered normal in terms of return interval. The Station fire area has not experienced a heavy rainfall event. The rainfall events during the first winter ranged from about 1 year to 5 year events. See Figure 1 below.
2. While some green-up has occurred, risk has not been reduced.
3. Upper elevations have less vegetation recovery.

4. Rill and gully networks are established.
5. Field observations indicate there is lots of material stored in channels and available for transport.
6. Debris flow potential still exists and has not been reduced.
7. Historic records indicate that winters 1 and 2 following a fire have relatively comparable potential for debris flows.
8. Risk to public still exists.
9. Risk to infrastructure still exists.

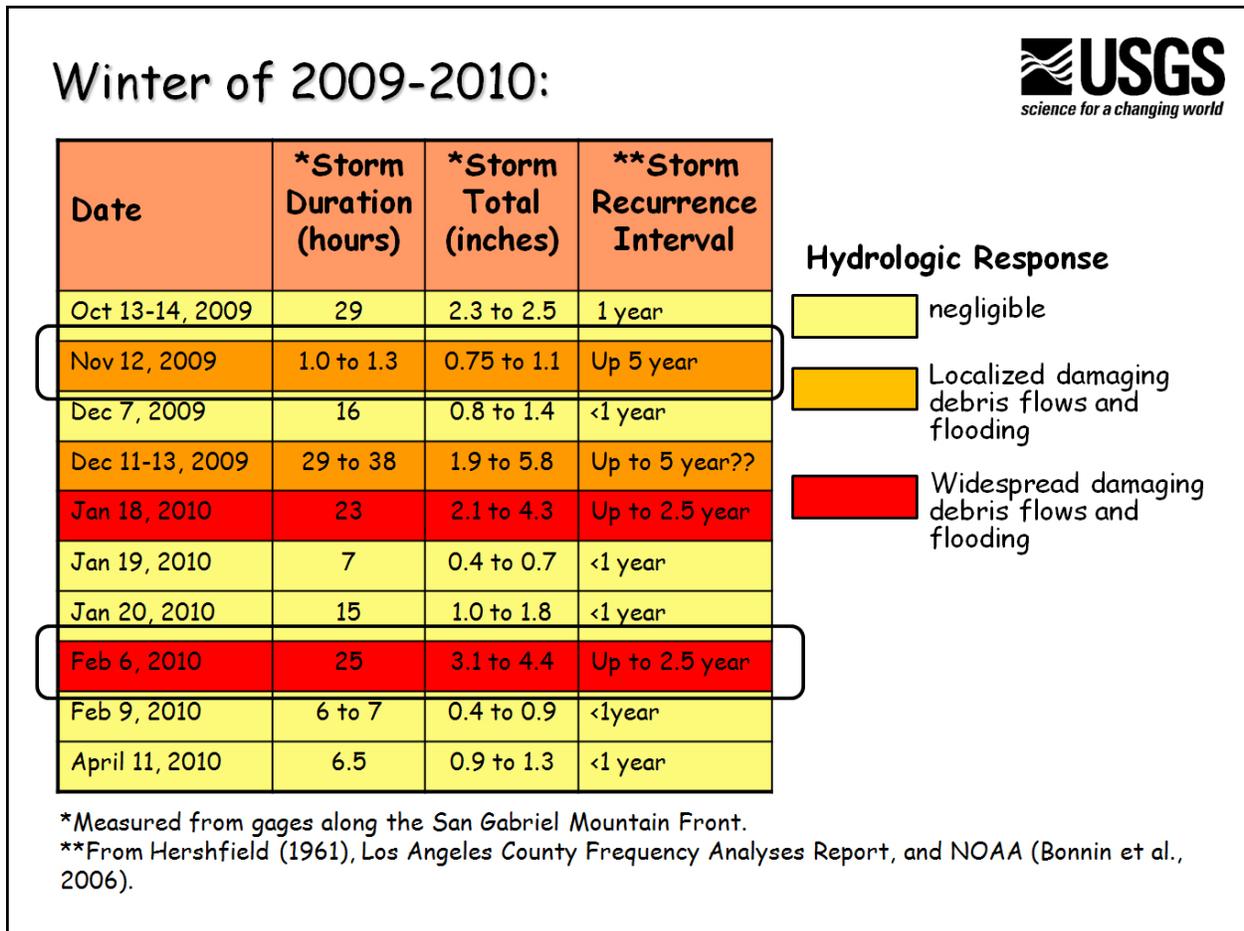


Figure 1: Slide presented by Dr. Sue Cannon, US Geological Survey, regarding precipitation events and associated watershed responses observed during 2009-2010 winter.

## Findings - Resource Specialist Group Reports

The Resource Groups that provided input during the BAER Assessment were asked to write a report for the Revisit that: compared what was predicted during Assessment for their resource with what happened the first winter after the fire; provided recommendations to the Forest for preparing for the second winter (2010/2011); and what was learned that would be useful for assessments of future large and complex BAER events like the Station fire.

Executive summaries for each resource group are presented below. Complete Resource Group reports are provided in the Appendix.

### Botany and Invasive Species

**Executive Summary:** Over the span of the seven months since the Station Fire, the vegetation in the burn area has responded much as anticipated in the Botany Technical Report of September 2009. Most of the burn area experienced an average level of rainfall during the winter and early spring months. This has resulted in a significant growth of annuals and re-sprouting of existing shrub/tree species within most of the lower elevations of the burn area. At the higher elevations (above 4000 ft) it is too soon in the growing season to definitively say that vegetation is recovering well, but it appears that many native annuals are germinating and re-sprouters already have some regeneration.

Even though native vegetation recovery is occurring, infestations of non-native species are also proliferating throughout many areas of the burn, mostly concentrated around areas of disturbance such as roads, trails, recreation areas, fuelbreaks/dozerlines, and utility corridors. So far it appears that non-natives are not as much of a threat to native plant recovery in undisturbed locations, with the exception of riparian areas, which have acted as vectors for weeds such as arundo to move downstream. Some early detection surveys have been completed however, the intended surveys have not started due to a workload issue in human resources on forest. Temporary 1039 or term employees have not been hired due to an already heavy workload within the Forest staff. The process was begun in November and we are still several months away from hiring. It is imperative that these detection surveys occur in order to locate and prioritize new and expanding invasive populations and to monitor potential non-native impacts to known rare plant populations.

Some treatments have been successfully implemented such as arundo treatments in Big Tujunga Canyon and Spanish Broom removal on the Santa Clara Divide Road. However, the single most important aspect of treatment is updating the NEPA to include treatment of invasive species using all possible tools, including herbicide. This will prevent type conversions and uncontrollable invasive species spread. Without this ability invasive species such as Spanish broom will spread in an exponential manner and increase fire risk and habitat degradation.



**Figure 2: Typical mountain slopes viewed during the week of May 10, 2010 showing variable levels of vegetative recovery. The level of vegetative recovery varied by aspect, elevation, bedrock, soil type, and the level of precipitation normal for the particular area of the fire.**

## Geology

**Executive Summary:** The Station Fire resulted in a greatly increased debris flow hazard for both intense, short-duration storms and lower intensity, longer duration ones. This posed a threat to both off-Forest residential areas and within Forest residences, recreational facilities, roads and trails. It also increased the likelihood of rockfall from steep areas upslope from certain roads, residences and facilities. The effect of the fire was to create an immediate and continuing need to clear dry ravel and rocks from roads and taxing the capacity of waste disposal areas.

Values at Risk (VARs) for debris flow and/or rockfall hazard included down channel, off-Forest populated areas where local, county and State entities were responsible for developing and implementing countermeasures to this increased threat. Other VARs included Forest Service Stations/residences and personnel, recreation residences, physical hazards at abandoned mines, roads and trails.

The governmental entities responsible for addressing the public safety hazard to off-Forest residential and commercial areas were provided with our technical information to assist in their efforts. Prescriptions for FS personnel safety, protection of Forest Service facilities and recreation residences

were successful where debris flow and rockfall hazard occurred with one exception. This exception was at Millard Canyon, a recreation residence, was impacted by a small debris flow.

Vegetation recovery has not significantly reduced the hazard of debris flow and rockfall due to the Station Fire. Therefore, the threat posed next winter (2010-2011) will be nearly as great as existed this past winter (2009-2010). It is recommended that prescribed measures for protection of Forest Service and non-Forest Service facilities within the Forest should be continued with preseason maintenance to ensure their being fully functional. Another recommendation is for the Forest to facilitate the placement of additional real-time reporting weather stations that would be operated by the National Weather Service, State or local agencies for early warning efforts. There should be continuation of the interagency coordination. The National Weather Service might be added to those entities involved in that coordination. The continuing need for debris disposal should receive greater attention to limit resource damage/impact from waste disposal locations.



**Figure 3: A debris flow path that existed before the fire, was re-activated during the 2009/2010 winter.**

## Soils

**Executive Summary:** The first winter over the Station Fire produced massive amounts of soil erosion, as predicted in the original assessment. Virtually all types of erosion were occurring – sheet, rill, gully, debris-flow, in-channel. Sediments were routed out of high gradient channels, and much of this was

subsequently deposited in low gradient channels as tributary alluvial fans and braided stream terraces, and is still available for transport next winter with high flow events. A well-formed upland rill and gully network is now in place for more efficient water transport, producing the possibility of flashier and higher flows in the lowlands and lowland stored sediments. Despite obvious vegetative recovery this year, on-site conditions indicate that second-year erosion rates may be similar to first-year; the hazards and risks are still present. Sediment basin capacities should still be expected to be challenged next winter. Higher elevation portions of the fire in the snow zone had very little surface and rill erosion. Hydrophobicity is still present and rather severe in much of the burn area, but then again the original assessment showed that unburned areas were similar and only somewhat exacerbated by the fire. However, water repellency did have some apparent influence on rilling initiation and depth of rills on upland soils lacking cover. Soils with different parent materials do have somewhat different erosion processes and mobilized materials, as seen at the Monte Cristo Station (white rock and soils) versus different areas. From observation of active hillslope erosion processes, it was agreed that hillslope treatments would have been ineffective, and the soil scientists substantiate the decision of no hillslope treatments as warranted and appropriate in this particular kind of terrain.



**Figure 4: Rill networks have formed which will concentrate runoff more efficiently and quickly the coming winter (2010/11).**

## Hydrology

**Executive Summary:** This report documents the findings from the Station Fire revisit in May 2010, which was conducted following the first winter post fire. Field visits to various locations within the fire area showed that most first and second order streams displayed signs of rill and gully networks. In many cases these rills and gullies are scoured down to bedrock. Stream channel deposition and stored sediment is very apparent in larger order streams down slope. Debris basins along communities in the front country were cleaned out on a regular basis by Los Angeles County Public Works following storms this winter. One debris basin above La Canada did over-top this last winter resulting in several structures being damaged. Vegetative recovery is ongoing and much greater along the front country. This recovery will not significantly reduce risks from the burn area over the 2010-2011 winter or if thunderstorms occur this summer and fall.



**Figure 5: Large quantities of sediment were transported and deposited during the 2009/2010 winter. This material could be transported further down stream in coming winters.**

## Wildlife and Fisheries

**Executive Summary:** The BAER Report for wildlife and fish identified Values at Risk that included USFWS threatened/endangered species and Forest Service Sensitive species and their associated habitats. It was predicted that post-fire events would lead to modification of suitable habitat and have the potential

to result in direct injury/mortality of individuals. Habitats most at risk included streams occupied by arroyo toad, mountain yellow-legged frog, California red-legged frog, Santa Ana sucker, Santa Ana speckled dace and arroyo chub.

Recommendations for management of special status aquatic species were developed as the result of interagency collaborations that included US Fish and Wildlife Service, USGS and California Department of Fish and Game. The BAER hydrology report was relied upon heavily to determine the level of risk for extirpation or reduced viability of native fish and amphibian occurrences in Big Tujunga Canyon, Devil's Canyon, Aliso Canyon and Soledad. Based upon predicted sediment and debris flows and potential for flushing flows, decisions were made to salvage native fish from Big Tujunga Creek and mountain yellow-legged frog tadpoles from Devil's Canyon.

Area closures were considered an important tool for protection of TEPS populations and sensitive habitats. Closures would facilitate vegetative recovery, reduce illegal OHV use and reduce recreation impacts to special status populations and their habitats. Monitoring has confirmed the effectiveness of closures in providing protection to special status populations and their habitats. Prior to lifting area closures, evaluation is needed to determine if adequate vegetative recovery has occurred.

Stream conditions have not stabilized and it is expected that concerns regarding special status aquatic species viability and their habitat will persist for the next 2-4 years. Monitoring and close collaboration with interagency partners will be essential in the development of future recommendations for habitat and special status species management.



**Figure 6: Big Tujunga Creek – May 11, 2010. Riparian vegetation and aquatic habitat was significantly altered during the first winter, post-fire flows.**

### Engineering (Roads)

**Executive Summary:** Initial observations of Forest Service roads within the burn perimeter were that roads had an unanticipated amount of sediment movement and loading into road drainages. These accumulations of debris, gravel and boulders eventually plugged road drainage features and deposited onto the road surface burying segments of roads under 3 to 5 feet of sediment. On some roads this resulted in blocking water flow and passage to BAER road treatments intended to facilitate and control increased water flows. It is determined that threats to life and safety will still exist from the events of summer thunder storms and the winters of 2010/11 and 2011/12.



**Figure 7: Large sediment loading in channels impacted road drainage.**

### Non-Motorized Trails

**Executive Summary:** Trails in the Station Fire were identified for BAER treatments by the Station Fire BAER assessment team. During early November 2009, I completed a brief field and map exercise to identify and prioritize trail sections for treatments. A map was developed showing identified trails. The Ranger District identified trails for priority. The method used to select trails for treatment was to consider trails within areas of moderate and high burn severity that had a gradient of 10% or greater that had a capacity to collect runoff from adjacent slopes with even greater slope angle. There was no comprehensive ground survey completed at the time due to lateness of the season and the upcoming winter storm season. A trail crew was brought in to do the treatments from the Stanislaus National Forest and completed a portion of the work for the identified trails. The crew worked on the Gabrieleno trail below Red Box gap, Silver Moccasin trail from Charlton Flat to Big Tujunga Creek, Pacific Crest Trail near Mill Creek saddle and Mount Gleason, and Falls Creek Trail near Singing Springs.

During the week of May 2-9, 2010, I joined with Andrew Fish, Angeles NF Trails coordinator to conduct intensive ground surveys of the identified trails for additional BAER treatments. We surveyed the following trails: Gabrieleno Trail (Switzer camp to Altadena and Red Box Gap to Switzer camp), Strawberry trail (from Highway 2 to Colby trailhead) Pacific Crest Trail (Pacifco Mountain to Mill Creek summit and PCT section 1 mile north of North Fork Station) and the Silver Moccasin trail (Charlton Flat

to Shortcut saddle). Surveys showed that a large portion of the trail sections were un-tread able due to large amounts of sediment and debris that have overwhelmed the trail bench cut, stream xings that have severely incised (wash out), slope failure where tread is missing and where trails follow stream courses have been washed out completely by floods. Some portions to a lesser amount were still intact that BAER treatments are still feasible. It appears that several sections of the trails surveyed will need to be reconstructed or have heavy trail maintenance done and need to be considered for long term restoration planning. BAER treatments completed on the Silver Moccasin trail were successful and helped to prevent severe trail degradation. In summary, there is still a need to complete additional BAER treatments on identified trails and to complete maintenance on treatments completed previously. Trails found to be destroyed or heavily impacted will need to be considered for long term restoration and are not applicable for BAER treatments. It is advised with the more unstable trails reconstruction may be premature and lead to failure if undertaken before watershed conditions stabilize over the next 2-3 years, and in some instances re-routes may be necessary for sustainable trails over the long term that will require further study and analysis.



**Figure 8: Trails have been damaged at stream crossings and dry ravel has narrowed or covered over the trail tread.**

## Heritage

**Executive Summary:** Wildfires have the potential to damage, or destroy cultural resources through: (1) direct effects of the intense heat and smoke; (2) ground disturbing rehabilitation measures; and/ or (3) soil movement caused by subsequent storm episodes. These impacts may completely destroy historic and archaeological resources or alter the context of surface and subsurface cultural remains important to scientific analysis and interpretation. Also, fires may increase the accessibility and visibility of archaeological site locations, creating a heightened susceptibility to vandalism, artifact looting, and unauthorized Off-Highway Vehicle (OHV) activity.

The Station Fire BAER Heritage measures were proposed at five prehistoric sites. Proposed treatment measures included alteration of runoff channels at specific locations; placement of energy dissipating devices in road drainages; the scattering of seed and straw or wood straw mulch to promote re-vegetation; and the erection of barriers to exclude people and vehicles from sensitive areas. The onset of winter precipitation immediately subsequent to the wildfire caused significant access issues that precluded the implementation of some proposed Heritage treatments. Upon later assessment, however, the proposed treatments may have either proved ineffective or unnecessary, as the resultant effects were found to be relatively minor. Further measures to be proposed focus on signage and monitoring, and minor treatment maintenance.



**Figure 9: Wood straw was applied to the soil surface at this heritage site to prevent erosion, but wind and runoff water has caused movement and clumping of the mulch material reducing its effectiveness.**

## Hazardous Materials

**Executive Summary:** Field observations of Forest Service buildings within the burn perimeter were that buildings had mulching application for Hazardous-Material Stabilization. The hydromulch treatments were prescribed to stabilize toxic materials created (asbestos-containing building materials and lead paint leaching out) and destabilized by the fire. Action taken on twenty five acres of small buildings and two large compound facilities and include two open spaces with hazardous wastes. This work of application of hydromulch as a BAER treatment, met the cover protection objective. Further monitoring of the hydromulch treatment and laboratory testing for amount of hazardous materials is needed. It is determined that the hazardous materials which pose post-fire, health, and safety concerns still exist for 2010/2011.



**Figure 10: Ground based hydromulch applied to burned structures effectively prevented off-site movement of hazardous materials.**



**Figure 11: A former shooting range was effectively stabilized with filter fabric and coir logs to prevent off-site movement of lead particles.**

## GIS Considerations for Large Fires

The Station Fire was a large and complex fire from a BAER Assessment standpoint. The following recommendations are offered to improve GIS support for such large and complex fires.

- 1) Bring on GIS personnel at least 1 day before the team arrives.**
  - a. Obtain GIS data
    - i. From the Forest
    - ii. Download (regional data, web data)
  - b. Organize data
    - i. File structure
    - ii. Build VAR GIS (or clean-up RAVAR data as necessary)
  - c. Set up plotter
  - d. Build preliminary maps
- 2) Have a regional list of folks with GIS skills for BAER**
  - a. Familiarity with Spatial Analyst, geodatabases & working with tables

**3) Establish a checklist for commonly used GIS for BAER incidents**

- a. To request data from Forest prior to arrival
- b. To reduce multiple trips to Forest during assessment

**4) At the end of assessment, turn GIS data over to Forest GIS Coordinator and/or a responsible person on the Forest (i.e., Lisa Northrop).**

**5) Order 4 GIS persons for large incidents**

- a. 3 BAER Team GIS people
  - i. 1 lead to coordinate
  - ii. 2 folks for mapping & analysis
- b. 1 BAER VAR economics GIS person
  - i. VAR is a huge workload for GIS
  - ii. Need VAR spreadsheet data entry to be compatible with GIS rules (i.e., formatting, site labeling)
  - iii. Simultaneous & coordinated data entry (spatial & tabular)



## Recommendations

### Recommendations to prepare for 2010/11 winter

The public and Forest Service employees need to be continually educated on the risks from the fire area. Flooding and debris flows in high-use areas, such as Arroyo Seco Canyon and Big Tujunga Canyon, still pose a significant threat to life and property.

- It is not recommended to open up Arroyo Seco Canyon or Big Tujunga Canyon until proper infrastructure and hazards are evaluated by an interdisciplinary team.
- Continued Forest Service involvement with the coordinated agency recovery effort (CARE) is recommended.
- Coordinate with the City of Pasadena for the construction work being completed in the mouth of the Arroyo Seco Canyon.
- It is recommended that the forest continue its cooperation with the Riverside Fire Lab and USGS with their studies of the fire area.
- Increase Forest employee awareness – If employees are out in field, take time to spot check infrastructure, clean out culverts, repair signs. Maintain due diligence.
- Interagency Coordination – provide (with interpretation) Jess Clark’s map of consolidated images from the first year’s growth. Use as tool for IDT when evaluating reopening.
- Generally closure should stay in place – vegetative recovery is critical for Ecosystem recovery.
- If site specific reopening is considered then we recommend interdisciplinary team approach to evaluate threats or risks to human life, safety, natural and cultural resources, such as listed below.
  - hazardous trees
  - hazardous materials, such as ash in stream deposits
  - hazards associated with burned facilities
  - risk of thunderstorm event/winter storms
  - use only seasonal, temporary reopening
  - ability to evacuate – ingress and egress
  - reopening not covered under BAER – change in patrol response funds
  - Look at sites on terraces, close to major access routes ex. Day use areas
- Rec Residences – consider seasonal closure at site specific areas.
- Due to the high risk of anticipated sediment loading at Monte Cristo and Angeles Crest Stations these facilities should be given a high priority for preparation before winter along with removal of the large propane tanks at these sites. Selected sites need re-hydromulching treatment before winter. Laboratory testing for amounts of hazardous materials at each site is needed. Develop an asbestos management plan.

- Regular monitoring (not BAER funded) of populations and habitat conditions within all occupied and suitable habitats will give biologists a stronger grasp of the year to year status and needs within each of the suitable watersheds in the fire. This will allow managers to be better prepared to respond to emergencies and guide non-emergency restoration and reintroduction efforts.

### Recommendations after the Team Reviewed Initial 2500-8

During the Revisit the Team reviewed the Initial 2500-8, Section H- Treatment Narrative section item by item to determine what emergency actions are needed to prepare for the upcoming 2010/11 winter. The following is a list of treatment names and recommendations for each.

#### Land Treatments:

- **Noxious Weed Detection Surveys:** Continue to assess current situation.
- **Non-native Aquatic Species Detection Surveys:** this treatment was not approved for the Initial 2500-8.
- **Unauthorized Access Vegetative Screening:** Recommendation: Continue to move forward with implementation. ANF will look at the closure treatment prescription, it may need modification.
- **Condor Protection and Removal of Microtrash:** Recommendation: 2 of 3 sites still need to be treated. Access for volunteers & USFS to sites has been challenging due to 2009/10 winter road closures. Need 'travel plan'.
- **Channel Treatments:** None recommended in Initial 2500. Recommendation: None

#### Road Treatments:

- **Recommendation:** Expand to other roads/areas where necessary for storm response & monitoring & culvert & drainage clean out.
- **Trail Evaluation and Implementation:** Recommendation: Further evaluate where BAER treatment trail prescription may be necessary (currently unidentified trails/segments). Improve/maintain/monitor existing in trail treatments for effectiveness.

#### Protection/Safety Treatments:

- **BAER Implementation/Interagency Coordination Team:** Recommendation: There should be continued coordination with Los Angeles County, NRCS, and the National Weather Service to maintain good communication for the 2010/11 winter. The Forest should contact the National Weather Service to see if they would like to site more precipitation stations within the Forest. More real time precipitation stations would aid identification of intense precipitation cells for storm warning forecasting.
- **Human Life and Resource Protection (Fire Area Closure):** Recommendation: Given the continued risk of significant watershed response and other hazards such as rockfall continued area closure is recommended. If partial opening is considered, then utilize IDT approach for evaluating areas proposed for opening for recreation within the fire area. There may be considerations regarding hydrologic and wildlife factors plus possibly threats to public safety

from hazardous materials that need to be assessed, such as ash deposits in riparian deposits or nearby burned buildings that pose a danger to curious individuals. Consider opening areas that are near improved roadways only, that do not require opening up secondary forest roads. Consider only seasonal partial openings with closure during the winter period. Consider limiting access to ‘rehabilitated’ fireline – these lines may invite unauthorized OHV travel. Rockfall, dry ravel & flash flooding remain a threat to life, safety & property. Impacts to aquatic habitat associated with recreation need to be considered. Signs & enforcement need to remain in place & maintained. Year 2 request for more signs.

- **Road Closure:** Recommendation: Gates have been installed, however some may allow entry around the gate with motorcycles. Monitor this season to determine if fencing or barriers are needed to prevent entry. Install smooth wire fences adjacent to gates. May need additional gates at rec sites.
- **Hazardous Material Stabilization:** Recommendation: Implemented. Close vault toilets. Remove hazmat from Monte Cristo Station or install geofiber to allow for future cleanup so any deposited sediment from runoff from upslope next winter can be separated from actual hazardous materials. This would reduce cost for remediation. Check sites to determine if maintenance of hydromulch, straw wattles, etc. to determine if retreatment is necessary for 2010/11.
- **Structure Protection:** Recommendation: Perform treatment maintenance this summer for functionality this winter.
- **Rock Fall Catch Fences and Mulching (Rec Residence protection):** Recommendation: Perform treatment maintenance this summer for functionality this winter.
- **Debris Flow and Flood Control (Rec Residence protection):** Recommendation: Perform maintenance this summer for functionality this winter.
- **Hazard Tree Mitigation:** Recommendation: Continue where needed to protect Forest Service or contractor personnel implementing or maintaining BAER treatments.
- **Abandoned Mine Closure:** Recommendation: complete implementation.
- **Special Status Species Salvage:** Recommendation: Continue Forest Service involvement.
- Arroyo Toad Protection: Recommendation: Shift emphasis to signage & monitoring (patrol).
- Spring Developments and Guzzlers: this was not approved in the Initial 2500-8

#### Cultural Resource Site Protection:

- FS# 05015500042: Recommendation: Maintain wattles.
- FS # 05015500032: Recommendation: Change emphasis to signs & monitoring.
- FS # 05015500163: NOT TREATED & no need to do so...
- FS # 05015500095: NOT TREATED & no need to do so...
- Protection Enforcement/Patrol: Recommendation: Continue.

## Monitoring

**Road Treatment Effectiveness Monitoring:** was not approved in the Initial 2500-8. Continue to utilize closure patrollers to detect road problems and maintenance needs.

**Area Closure Effectiveness Monitoring:** approved closure patrol will provide feedback on area closure effectiveness.

**Vegetation Recovery/Invasives/Species at Risk /Closure:** continue

**Heritage Resource Treatment Monitoring:** continue

## Long Term Rehabilitation and Restoration Recommendations

1. Establish long-term monitoring program for nonnative, invasive wildlife (ex. bullfrogs) and plants (ex. arundo). Develop agreement with local universities to develop and implement study design. “Greenthumbs” volunteer program from SBNF.
2. Develop site plan for removal of hazardous materials from NF Lands.
3. Develop and install interpretive panels regarding post-fire processes. Could install along Tujunga Route at various turnouts/vantage points.
4. Develop NEPA for forest-wide herbicide use (Look at recent document created for Broom removal on SBNF – Dev Kopp)
5. Infrastructure Restoration – Pursue additional funding for facilities that still need work ex. Monte Cristo Station – smoke damage, power line repair
6. Consider future post-fire potential threats to facilities when locating new facilities or replacing lost facilities. Use ID Team approach to evaluate all possible effects.
7. Develop an adopt-a-trail volunteer group to help with long-term maintenance and reconstruction
8. Long term rehabilitation and restoration of trails should wait until vegetative recovery has slowed dry ravel and with it the narrowing or filling of the trail tread. It is recommended an experienced trail specialist or watershed specialist oversight to crews during planning and implementation.
9. Remove the abandoned conventional water treatment plant at Barley Flats.
10. Ecosystem Restoration – allow natural processes to continue to occur (ex. dynamic development of braided channels and continued establishment of sandy benches)

## Recommendations for Future BAER Assessments of Large, Complex Fires

These comments are in addition to those in the Assessment After Action Review in Appendix.

- Details about Area Closures should be determined by an interdisciplinary team/approach beyond just the BAER assessment. Forest staff from multiple disciplines should have a discussion before roads area opened to the public.
- Need to anticipate during Assessment that access roads may become closed due to mass soil movement or other kinds of storm road damage, so BAER treatments may not be able to be implemented in timely manner.

- During large or complicated BAER assessments, it is especially important to ensure that conflicts between different prescriptions for the same site are reviewed to avoid duplication or conflicting results.
- **Treatment database:** A regional treatment database would be helpful for those BAER personnel without decades of experience. This database could be populated during the assessment, during implementation, and after any reviews of treatment effectiveness. Such a database could include treatment descriptions, cost estimates, diagrams or photos, actual costs, contractors used, and whether the treatment was a success.
- **Revisits:** The process of the fire revisit was absolutely invaluable for understanding ecotype and verifying or modifying assumptions used in the rapid assessment process. This should be considered more frequently, particularly for large and complex incidents. Although it would be cost prohibitive to regularly hold revisits with all personnel involved, costs could be controlled by holding them with only resource leads.
- **Soils:** Several significant observations were made during our BAER revisit. We observed that areas within the snow zone did not show significant rill erosion, something that was included in the climate functions of our erosional modeling. We also observed significant differences in watershed response, vegetation recovery, and erosional processes that can be related to the underlying parent materials and subsequent differences in soil characteristics.
- **Soils:** Several days were devoted on the Station Fire for the erosion modeling. Given uncertainties with the available models, perhaps the time could have been more appropriately spent on the ground validating soil burn severity, describing soil properties and how they influence types and magnitude of erosions, developing a better understanding of geology and soil relationships, and getting more data on hydrophobicity. It is clear that our knowledge of the role hydrophobicity plays in post-burn soil hydrologic function and ecologic recovery is still largely unknown. We need to review and develop a better understanding of hydrophobicity in this and other fire-prone areas.
- **Hydrology:** The Station Fire provided an opportunity to have multiple agencies conduct studies on the fire area to help with our analysis on future fires. One of the preliminary findings was that ten minute rainfall intensity was the triggering event that caused peak flows. This presents a problem because the national weather service does not provide information for storm intensities under a one hour.
- **Wildlife:** Treatments such as the construction of off-channel pools can be highly effective in creating suitable habitat for aquatic species such as the California red-legged frog.
- Species salvage can be beneficial and appropriate, but is not warranted for all species or in response to all fire events.
- Determining the appropriate length for closure can be difficult to identify and requires an interdisciplinary approach.

- Successful species salvage requires the following: an interagency approach, approved facilities for holding individuals and a strategy for the reintroduction of salvaged individuals.
- Availability of crews limits feasibility of implementing adequate patrols and enforcement. This is critical where closure is identified as a primary means of resource protection.
- Pre-work or planning for BAER trail treatments before actual implementation in terms of location and site suitability and to provide technical oversight pre-work layout and with implementation crews will increase success of BAER treatments. Assessment teams need to figure into cost analysis for this to be done as it is not feasible to conduct pre-implementation ground work for trails treatments due to time constraints. It is also important to include Forest recreation and trails personnel with the BAER assessment team to provide specific information on trail conditions and areas to help determine where trail treatments are needed and to understand logistics that will help with cost estimates.
- Lesson learned for the hydromulch treatments for hazmat stabilization: They were installed before the winter season but they will not last or function as expected for 18 months to 2 years. State and County road closures prevented Forest Service and contractors from accessing locations designated for additional hydromulch treatments during the contract period.

Pluses and Minuses of Using Local Forest Personnel for Implementation:

- **Plus:** Use local Forest personnel if possible: Having employees from the Angeles NF proved to be a high value for both the assessment and implementation of the BAER treatments. Their expertise included helping develop contracts coordinating work and serving as COR's over prescribed work.
- **Minus:** It is very difficult to hire new employees to complete BAER treatments. Given full workloads of existing employees, very little time can be spent on implementation projects. Need to think of better ways to facilitate implementation treatments and hiring.

### GIS Recommendations for Large Fires

The Station Fire was a large and complex fire from a BAER Assessment standpoint. The following recommendations are offered to improve GIS support for such large and complex fires.

- 1) **Bring on GIS personnel at least 1 day before the team arrives.**
  - a. Obtain GIS data
    - i. From the Forest
    - ii. Download (regional data, web data)
  - b. Organize data
    - i. File structure
    - ii. Build VAR GIS (or clean-up RAVAR data as necessary)
  - c. Set up plotter
  - d. Build preliminary maps

- 2) Have a regional list of folks with GIS skills for BAER**
  - a. Familiarity with Spatial Analyst, geodatabases & working with tables
- 3) Establish a checklist for commonly used GIS for BAER incidents**
  - a. To request data from Forest prior to arrival
  - b. To reduce multiple trips to Forest during assessment
- 4) At the end of assessment, turn GIS data over to Forest GIS Coordinator and/or a responsible person on the Forest (i.e., Lisa Northrop).**
- 5) Order 4 GIS persons for large incidents**
  - a. 3 BAER Team GIS people
    - i. 1 lead to coordinate
    - ii. 2 folks for mapping & analysis
  - b. 1 BAER VAR economics GIS person
    - i. VAR is a huge workload for GIS
    - ii. Need VAR spreadsheet data entry to be compatible with GIS rules (i.e., formatting, site labeling)
    - iii. Simultaneous & coordinated data entry (spatial & tabular)



## Appendix 1: After Action Review Station Fire Assessment

### What can be improved and suggestions for future incidents

1. **Radio communication**

- a. Challenging for this fire, and not uncommon for other fires. Need to continue to work with IMT.

2. **Treatment progression - Improve treatment development and coordination among specialist groups.**

- a. Start discussion of treatments earlier in the process.
- b. Use of google application combined with GIS.
- c. Develop and provide spec sheets so formats are same when consolidating.

3. **Duplication of effort**

- a. Improve communication & site visit coordination – helped to plan days activities the night before.
- b. Utilize interdisciplinary teams( ex. hydro, soils, geol, and fisheries)
- c. Establish common data sheet (i.e. for assessing recreation facilities, trails, hazard trees)
- d. Improve ways to capture data - use of data loggers in field
- e. Use of spec sheets to track VAR and Treatments
- f. VAR, labeling map codes for value rather than resource that identified the value at risk.

4. **Calibration day**

- a. Pair up resources that make sense together – ex. Soils & geo & hydro

5. **Sampling large burned area was very challenging**

- a. Consider sampling as a team by watershed – use of interdisciplinary groups
- b. Consider dividing up fire by divisions to ID values at risk

6. **Too many people involved in data management** – designate one person to manage data throughout assessment

7. **Lack of recreation input** – needed more input from Forest

8. **Core team with group leads** – worked well, may consider opening meetings for observations with core team leaders providing input.

- a. Communicate role to team leads
- b. Group leads were link between small and large group - accountable for tasks (demob, SAFETY, reporting, daily data dumps, cost tracking...)

9. **Central location for data** – continue to develop and improve VAR tool

10. **Scheduling of the closeout** – try to schedule so team members can demob the following day
11. **Bring team lead(s) and GIS to incident one full day before rest of team to allow for setup and orientation.**

### Worked well

1. Coordination with partners – key to success of Assessment
2. GIS – provided excellent support
3. Specialist staffing
4. AM fire & safety briefings – from Ron Ashdale
5. BAER support from ANF – daily conference calls, support from ANF was critical to success of team
6. Lisa/Jody support
7. Having Brent Roath on team - improved efficiency throughout process
8. Social Direction (Dan Teater) – critical in maintaining team moral
9. GIS/Google combo
  - a. Common Operating Picture (COP) by the GETA guys
10. Facilities - appropriate, worked well
11. VAR exercise/calibration day with core team
12. Final BARC
13. PIOs, Richard & Cathleen
14. Interagency Liaison
15. Team leader communication with everyone about expectations and hard timelines at the outset was very powerful.
16. Integration with USGS supporting geologists.
17. Having Terry Hardy & Eric Nicita there ‘fresh’ off the Morris fire with the ANF GIS library & knowledge of what was going on at the Station before the team arrived.

## Appendix 2: Station Fire BAER Implementation – Lessons Learned

*Justin Seastrand, Natural Resource Specialist, Station BAER Implementation Team Leader*

- **Assessment vs. Implementation – best viewed as two parts of a whole**
  - Need more experience and cross training with both parts
  - Consider using assessment team members for Implementation – willingness and ability to take assignments for both will really help
  - Implementation Skills – IAS Entry, COR Training, Budgeting/Cost Tracking, Knowledge of IDIQ contracts
- **Station Fire – what worked**
  - Solid scientific justification for not doing landscape treatments
  - PIO/Outreach as part of implementation team
  - Good local staff input on many treatments
  - Excellent contracting support from RO
  - Most resources had good supporting documentation/reports
  - While costs were off on some treatments, the majority were over funded, not under funded – team did a good job of making sure the forest had enough \$\$
  - Good funding for archeology and biology monitoring
- **Station Fire – what can improve**
  - Last minute “oh by the way” treatments – better left for interim requests
  - Cost estimates – consider ways to get more accuracy. On large teams, assign one person to help with market research, product reviews and specs, etc. Smaller teams could take an extra day to tighten down estimates
  - Avoid assumptions that hiring or using in house crews is better – contracting is the way to go on most treatments.
  - Better interdisciplinary communication - the more team members are aware of what other team members are considering the better. Consider core team site visits instead of smaller groups going separate ways.
  - More detailed assessment of recreational facilities – a true recreation assessment is critical on such a high use forest.
  - Consider potential for access restrictions – they were a major hurdle on this one
- **Programmatic Issues**
  - Need policy guidance on the private property/public land issue (rec cabins)

- Contracting – the RO letter helps, but still does not allow for treating BAER work as true emergency. AQM staff have to be available.
- BAER Implementation cannot and should not be run as a fire incident. We tried to make it work and it did not. (O and S numbers and I-Suite). Implementation teams don't need as many positions (Documentation vs. Budget/Finance for example)

### Appendix 3: Participants - Station Fire BAER Revisit

NAME	Station Fire BAER Role	Home Unit
Allen King	Geology	Consultant-AD
Andrew Fisher	Trails	Angeles NF
Brad Burmark	VAR Tool	R5
Brent Roath	R5 BAER Coordinator	R5
Carly Gibson	BAER Team Leader-Trainee	Stanislaus NF
Casey Shannon	Hydrology	Inyo NF
Chris Stewart	Hydrology	Sequoia NF
Cliff Johnson	THSP - Lands & Survey	Angeles NF
Dan Teater	Biology/Fisheries	Tahoe NF
Darrel Vance	Heritage	Angeles NF
Dave Young	Soils	Shasta-Trinity NF
David Peebles	Heritage	Angeles NF
Eric Martindale	Engineering	Angeles NF
Eric Nicita	Soils	El Dorado NF
Janet Nickerman	Botany	Angeles NF
Jason Jimenez	Soils	Cleveland NF
Jerry DeGraff	Geology	Sierra NF
Jess Clark	BARC	Remote Sensing Application Center
Jody Noiron	Forest Supervisor	Angeles NF
Joe Gonzales	Haz Mat	Angeles NF
Justin Seastrand	Implementation Team Leader	Angeles NF
Katie VinZant	Botany	Angeles NF
Kevin Cooper	Assistant Team Leader	Los Padres NF
Kyle Wright	Hydrology	Sequoia NF
Leslie Welch	Biology	Angeles NF
Lisa Northrop	Forest Resource Officer	Angeles NF
Marc Stamer	BAER Team Leader	San Bernardino NF
Mark Schug	GIS	Stanislaus NF
Paul Gregory	Forest Hydrologist	Angeles NF
Penny Luehring	National BAER Coordinator	WO –virtual Albuquerque, NM
Pete Wohlgemuth	Hydrology	PSW-Riverside
Rusty LeBlanc	Engineering	Stanislaus NF
Sue Cannon	Geology	US Geological Survey – Denver
Tim Biddiner	Hydrology	Tahoe NF
Todd Ellsworth	Facilitator for Revisit	Inyo NF
Yonni Schwartz	Geology	Los Padres NF



## Appendix 4: Resource Specialist Reports

### Resource: Botany and Invasive Species Report

*Authors and Home Unit: Janet Nickerman and Katie VinZant, Angeles National Forest*

**Executive Summary:** Over the span of the seven months since the Station Fire, the vegetation in the burn area has responded much as anticipated in the Botany Technical Report of September 2009. Most of the burn area experienced an average level of rainfall during the winter and early spring months. This has resulted in a significant growth of annuals and re-sprouting of existing shrub/tree species within most of the lower elevations of the burn area. At the higher elevations (above 4000 ft) it is too soon in the growing season to definitively say that vegetation is recovering well, but it appears that many native annuals are germinating and re-sprouters already have some regeneration.

Even though native vegetation recovery is occurring, infestations of non-native species are also proliferating throughout many areas of the burn, mostly concentrated around areas of disturbance such as roads, trails, recreation areas, fuelbreaks/dozerlines, and utility corridors. So far it appears that non-natives are not as much of a threat to native plant recovery in undisturbed locations, with the exception of riparian areas, which have acted as vectors for weeds such as arundo to move downstream. Some early detection surveys have been completed however, the intended surveys have not started due to a workload issue in human resources on forest. Temporary 1039 or term employees have not been hired due to an already heavy workload within the Forest staff. The process was begun in November and we are still several months away from hiring. It is imperative that these detection surveys occur in order to locate and prioritize new and expanding invasive populations and to monitor potential non-native impacts to known rare plant populations.

Some treatments have been successfully implemented such as arundo treatments in Big Tujunga Canyon and Spanish Broom removal on the Santa Clara Divide Road. However, the single most important aspect of treatment is updating the NEPA to include treatment of invasive species using all possible tools, including herbicide. This will prevent type conversions and uncontrollable invasive species spread. Without this ability invasive species such as Spanish broom will spread in an exponential manner thereby increasing fire risk and habitat degradation.

#### Values at Risk

Thirty seven plant communities were burned or impacted by suppression activities of during the Station Fire. In addition, there is occupied and potential habitat for one federal endangered plant species and eleven Forest Service Sensitive plant species. Some of these habitats and species are at risk to further losses. For example, disturbances/degradation from post-fire impacts of sediment and ash delivery will result in loss of water quality, scouring of riparian systems and loss of wildlife habitat at natural springs and spring developments due to sediment delivery and erosion. In addition, vegetation community recovery is at risk for delayed recovery due to invasive species and illegal Off Highway Vehicle (OHV) activity.

### **Summary of Initial Concerns**

- Invasive species spread (see Specialist Report for Noxious Weeds and Non-native invasive plant species).
- Illegal Off Highway Vehicle traffic i.e., Impacts to habitat/vegetation as a result of loss of barriers and off-road vehicle incursions
- Disturbance associated with increased need for road maintenance to prepare for winter storms
- Increased dispersed recreation use due to loss of native vegetative barriers
- Desert scrub and high intensity burns in coniferous plant communities are the most vulnerable to delayed recovery.

### **BAER Treatments Prescribed**

- Burn Area Closure
- Noxious Weed Detection Surveys and Expansion Treatments
- OHV Vegetative Screening
- Treatment Effectiveness Monitoring and Enforcement Patrol

### **Post Fire Findings**

Over the span of the seven months since the Station Fire, the vegetation in the burn area has responded much as anticipated in the Botany Technical Report of September 2009. Most of the burn area experienced an average level of rainfall during the winter and early spring months. This has resulted in a significant growth of annuals and re-sprouting of existing shrub/tree species within most of the lower elevations of the burn area. At the higher elevations (above 4000 ft) it is too soon in the growing season to definitively say that vegetation is recovering well, but it appears that many native annuals are germinating and re-sprouters already have some regeneration.

As described in more detail in the Botany Specialist Report, the native vegetation within the burn area is recovering well due to a combination of factors. These include the native vegetation's adaptation to fire, the fire return interval being over 30 years in many of the burned areas, and the average rainfall year. Burn areas that seem to be experiencing a slower recovery are those locations where the factors listed above have not occurred simultaneously. These areas primarily occur on the drier, northern slopes composed of desert transition chaparral and California juniper/pinyon pine scrub, which are adapted to longer fire return intervals (50-200 years) and typically recover more slowly to post-fire. A small portion of this more desert-influenced vegetation around Indian and Mill Canyons was burned 3 years ago in the North Fire and then re-burned in the Station Fire. This return interval is much accelerated from the historic burn frequency for these vegetation types and it appears that portions of this area are going to undergo type conversion to non-native grassland vegetation.

One larger scale area that appears to have a potential for slower vegetation recovery is the hillslopes on either side of Upper Big Tujunga Road (3N19). It is unclear this early in the growing season if this

slower recovery is simply due to a higher elevation range, or if a number of factors such as higher fire burn intensity and poorer soil nutrient availability are also contributors.

Many of the known sensitive plant populations described in the Botany Report have not been revisited yet, as it is still early in the growing season. Due to the Forest closure most of these populations have not been impacted by human disturbances.

The most significant negative influence upon the vegetation recovery throughout the burn area is the abundance of invasive plant species, namely non-native grasses, Spanish broom, arundo, red stemmed filaree, and shortpod mustard. These species are mostly concentrated around areas of disturbance such as roads, trails, recreation areas, fuelbreaks/dozerlines, and utility corridors. So far it appears that non-natives are not as much of a threat to native plant recovery in undisturbed locations, with the exception of riparian areas, which have acted as vectors for weeds such as arundo to move downstream. This flush of non-natives was expected due to the lack of competition from dense native vegetation on the burned slopes, the many vectors for weed seed dispersal throughout the burn area (e.g. dozerlines, roads, trails, watercourses), a significant amount of rainfall, and the weed species propensity for increased proliferation after fire and other ground disturbances.

Another detrimental influence upon native vegetation recovery, found to be occurring on the northern boundary of the burn area, is unauthorized off-road vehicle activity. This is in the open and flat terrain of the Aliso Canyon area.

#### **Recommendations for 2011**

- Need to continue monitoring and treatment of non-native populations treated in 2010
- Patrol and monitoring of unauthorized OHV use
- Continue closure of most interior/dirt ANF roads in the burn area. When safe, allow access by foot, but no mechanized equipment. This will promote stronger vegetation recovery and lessen chances of weed invasion.
- If the Forest closure is lifted in 2011 and all roads are opened, OHV barriers need to be installed to discourage off-road use
- For rest of 2010: Still need to complete vegetative screening treatments and continue survey and eradication of non-natives

#### **Lessons Learned for Upcoming BAER Assessments**

- It is very difficult to hire new employees to complete BAER treatments. Given full workloads of existing employees, very little time can be spent on implementation projects. Need to think of better ways to facilitate implementation treatments and hiring.

#### **Lessons Learned for BAER Process**

- Area closure details should be determined by an interdisciplinary team/approach beyond just the BAER assessment. Forest staff from multiple disciplines should have a discussion before roads area opened to the public.

- Very difficult to implement BAER treatments with FS employees who already have full workloads.

**Summary Table**

Resource Area	VAR	Threat (Debris Flow, Soil Erosion, etc.)	Risk (H,M,L)	Action Taken (Treatment)	What Happened? (Findings)	Recommendations (Winter 10/11)	Lessons Learned
<b>Botany</b>	Vegetation Recovery	Weed Invasion	H	Survey and Treatment of Weed Populations	Still need to complete most surveys. Have successfully eradicated several populations of arundo and Spanish broom	Continue eradication treatments	Difficult to hire new employees to complete BAER treatments, which is necessary given heavy workloads. Need to try to start eradication treatments as early as possible.
	Area Closure	OHVs, weeds	H	Burn area closed	In most areas closure seems to be working.	Continue closure at least to mechanized vehicles	
	Vegetative Screening	OHV, weeds	H	Not completed yet		Monitor and maintain vegetative screening locations	This treatment has been difficult to implement as of yet due to a lack of personnel time and native seed availability limitations

**Resource: Engineering (Roads)**

*Authors and Home Unit: Rusty LeBlanc Stanislaus NF, Eric Martindale, Angeles NF, Cliff Johnson Angeles NF.*

**Executive Summary:** Initial observations of Forest Service roads within the burn perimeter were that roads had an unanticipated amount of sediment movement and loading into road drainages. This accumulations of debris, gravel and boulders eventually plugged road drainage features and deposited onto the road surface burying segments of roads under 3 to 5 feet of sediment. On some roads this resulted in blocking water flow and passage to BAER road treatments intended to facilitate and control increased water flows. It is determined that threats to life and safety will still exist from the events of summer thunder storms and the winters of 2010/ 11 and 2011/12.

**VAR, Threat and Risk to Resource Area**

There is a continued risk to Forest visitors, permittees, private in holders, and Government employees using and working in the National Forest. This includes but not limited to Roads, Trails, Administrative sites, Campgrounds and other facilities within and outside the Station Fire perimeter. Loss of control of water resulting in flooding, debris and sediment movement onto roads , trails and facilities occupied by

users. Rock fall, tree fall, landslides, road washouts and entrapments, are considered a continued risk to users.

There is a continued risk to the Forest Service INFRA structure (roads ). These roads are a Government asset and are needed for long term administrative, emergency, recreation, permittee, power and communication sites access.

The road is considered the value at risk when there is a loss of road function and access is denied, and the cost to repair the damage anticipated, is greater than the cost to prevent that damage.

#### **What happened during the winter of 2009/10**

Approximately 34 inches of precipitation was recorded at Big Tujunga Dam the Forest Service road system within the fire perimeter experienced higher level of sediment loading than was originally anticipated, installed BAER road treatments accounted and planned for increased flows and sediment loading but was not anticipated at the high volumes that occurred. The majority of the installed road treatments were tested and functioned as predicted, other road treatments showed evidence of not functioning as expected because of the higher than anticipated sediment loading.

#### **Why did it happen?**

Many areas within the burn had not burned for decades, accumulative effects of debris and sediment loading in channels above roads combined with high severity burned hill slopes contributed to the unanticipated higher than predicted movement of debris and sediment off the slopes and drainages and into road drainage features and onto the road surface.

#### **Recommendations next winter 2010/2011**

Prepare debris and catch basins by cleaning out accumulative material before the 2010 / 11 winter, maintain installed BAER road treatments through the use of continued Storm monitoring and response. Due to the high risk of anticipated sediment loading at Monte Cristo and Angles Crest Stations these facilities should be given a high priority for preparation before winter along with monitoring and storm response.

#### **What did you learn from the burned area survey?**

Due to time and access constraints further assessments of some roads were recommended but not accomplished prior to the first winter rains. Some site specific road treatments were not installed in a timely manner because of debris and sediment deposited on roads prevented contractor access to individual sites. Additionally State and County road closures also prevented Forest Service and contractors from accessing roads scheduled for treatments i.e. monitoring and storm response.

#### **What did you learn that will be useful?**

Local engineers from the Angeles NF proved to be of high value for both the assessment and implementation of the BAER road treatments, they provided continuity between the assessment and the implementation team during the transition period. Their expertise included helping develop contracts coordinating work and serving as COR's over the prescribed work. Local implementation team leader

Justin Seastrand did a commendable job of organizing the tasks and implementing the treatments, however he was not able to coordinate and transitions with the assessment team in a timely manner. Road closure Policies by local State and County road agencies hampered the ability of the Forest Service and contractors to access areas of identified road treatments.

**Please summarize your results in the table below:**

Resource Area	VAR	Threat (Debris Flow, Soil Erosion, etc.)	Risk (H,M,L)	Action Taken (Treatment)	What Happened? (Findings)	Recommendations	Lessons Learned
Roads	Life and Property	Sediment and debris flows, erosion of road prism	H	Overside drains, risers, drain and basin cleanouts, storm monitoring and response	Roads were protected	Clean catch basins of accumulated sediment before winter. Continue maintenance of installed treatments through winter preparation and storm monitoring and response	

**Resource: Geology**

*Authors and Home Unit: Jerome DeGraff (Sierra NF), Jonathan Yonni Schwartz (Los Padres NF) and Allen King (Los Padres NF-retired)*

**Executive Summary:** The Station Fire resulted in a greatly increased debris flow hazard for both intense, short-duration storms and lower intensity, longer duration ones. This posed a threat to both off-Forest residential areas and within Forest residences, recreational facilities, roads and trails. It also increased the likelihood of rockfall from steep areas upslope from certain roads, residences and facilities. The effect of the fire was to create an immediate and continuing need to clear dry ravel and rocks from roads and taxing the capacity of waste disposal areas.

Values at Risk (VARs) for debris flow and/or rockfall hazard included down channel, off-Forest populated areas where local, county and State entities were responsible for developing and implementing countermeasures to this increased threat. Other VARs included Forest Service Stations/residences and personnel, recreation residences, physical hazards at abandoned mines, roads and trails.

The governmental entities responsible for addressing the public safety hazard to off-Forest residential and commercial areas were provided with our technical information to assist in their efforts. Prescriptions for FS personnel safety, protection of Forest Service facilities and recreation residences were successful where debris flow and rockfall hazard occurred with one exception. This exception was at Millard Canyon, a recreation residence, was impacted by a small debris flow.

Vegetation recovery has not significantly reduced the hazard of debris flow and rockfall due to the Station Fire. Therefore, the threat posed next winter (2010-2011) will be nearly as great as existed this past winter (2009-2010). It is recommended that prescribed measures for protection of Forest Service and non-Forest Service facilities within the Forest should be continued with preseason maintenance to ensure their being fully functional. Another recommendation is for the Forest to facilitate the placement of additional real-time reporting weather stations that would be operated by the National Weather Service,

State or local agencies for early warning efforts. There should be continuation of the interagency coordination. The National Weather Service might be added to those entities involved in that coordination. The continuing need for debris disposal should receive greater attention to limit resource damage/impact from waste disposal locations.

#### **VAR, Threat and Risk to Resource area?**

"The Station Fire has created an emergency situation by accelerating natural geologic processes through its effect on vegetative cover and soil condition. This results in a greater likelihood and larger size of potential debris flows during future rainfall events for at least two years, and increased slope instability, primarily rockfall. The debris flow hazard is widespread through much of the burned area due to the significant extent of moderate and high burn severity. Increased rockfall hazard occurs at more specific locations scattered throughout the affected area. Both geologic hazards impact values at risk (VAR) resulting in site-specific emergency situations. The risk to human lives and infrastructure posed by this emergency is very high due to the probability of damage or loss being likely and the magnitude of the consequences ranging from major to moderate. In addition to the risk to humans and property, there is also a very high risk due to the loss of water control and water quality. Assessments carried out by the geology group of the BAER team identified twenty eight (28) abandon mine sites within the fire parameter located within ½ mile of a road. The increased visibility and accessibility by the public to these sites as a result of the fire magnifies the probability of injury or fatality (Final Specialist Report-Geologic Hazards, 2009)."

Values at Risk (VARs) for debris flow and/or rockfall hazard included down channel, off-Forest populated areas where local, county and State entities were responsible for developing and implementing countermeasures to this increased threat. Other VARs included Forest Service Stations/Residences and Personnel (Angeles Crest FS, Big Tujunga/Vogel Flat FS, Monte Cristo FS, Clear Creek FS and Shortcut FS), recreation residences (Delta Flat, Trail Canyon, Big Tujunga/Vogel Flat, La Paloma and Millard Canyon), physical hazards at abandoned mines, roads and trails.

#### **What happened during the winter of 2009/10 in regard to your resource or facility?**

The governmental entities responsible for addressing the public safety hazard to off-Forest residential and commercial areas were provided with our technical information to assist in their efforts. Several storm events took place to test the effectiveness of their measures as well as those measures within the Forest to prevent or limit the impact of debris flow and rockfall hazard. Both intense, short duration and lower intensity, long duration storms occurred; notable those on Nov. 12, 2009, Dec. 11-13, 2009, Jan. 18, 2010 and Feb. 6, 2010 (Fig. G1). However, these storms were a lesser magnitude than the design storms used for evaluation of debris flow hazard. Prescriptions for FS personnel safety, protection of Forest Service facilities and recreation residences were successful where debris flow and rockfall hazard occurred with one exception. This exception was at Millard Canyon, a recreation residence, was impacted by a small debris flow which occurred before the prescribed mitigation was completed. At Monte Cristo Station, k-rails successfully diverted sediment from impacting the unburned house or the engine facilities (Fig. G2). The transported material deposited, as designed, in the area of the burned house. Angeles Crest Station structures to protect the station's propane and retardant tanks showed evidence they successfully protected against sediment and rocks. In other instances, prescriptive measures were not fully put to the test. The personnel warning system instituted through Dispatch functioned effectively to provide timely warning to employees. Both LA County Public Works and Caltrans have side-cast soil/rock debris at

points along their roads within the Forest. It is unclear what necessitated this action, but the result was to locally increase the sediment directed to Big Tujunga and Arroyo Seco.

#### Why did it happen?

The burned area received a number of storms and landscape responded as numerous studies of burned watersheds would predict.

#### Recommendations for next winter (2010/2011)?

Based on the observations during the revisit, there are no additional geology-related treatments needed. It should be noted that the increased threat of debris flows and rockfall due to the Station Fire largely remains the same for the winter of 2010/2011 as it was for the winter of 2009/2010. The significant storms experienced between Nov. 12, 2009 and Feb. 6, 2010 caused significant amounts of sediment to be eroded in the headwaters (1<sup>st</sup> order channels) (Fig. G3). This creates a very efficient channel for directing water in future storms into the large quantity of sediment stored in the downstream channels. The limited vegetative recovery will not significantly reduce this continuing threat.

The key point is the need to continue the prescriptions and measures instituted for last winter (2009/2010). **It is absolutely necessary to perform maintenance on measures at Forest Service Stations/Residences and personnel (Angeles Crest FS, Big Tujunga/Vogel Flat FS, Monte Cristo FS, Clear Creek FS and Shortcut FS) and recreation residences (Delta Flat, Trail Canyon, Big Tujunga/Vogel Flat, La Paloma and Millard Canyon) before the rainy season to ensure these prescriptive measures are fully functional.** Also, it is important that mitigation of the physical hazard posed by mine openings, authorized by the BAER assessment, be completed as soon as possible.

Two modifications are suggested for existing implemented measures. First, coordination with other government entities for Station Fire should be continued with the addition of the National Weather Service as one of the agencies included. This should include the Angeles NF facilitating placement of additional real-time reporting weather stations in the burned area as part of improving the storm warning system by actively engaging the National Weather Service and others in this effort rather than waiting for them to come forward with requests.

Second, the hazmat stabilization for the burned residence at Monte Cristo Fire station should be covered with geotextile which is already available in rolls on the site. This material pinned on the deposited material will provide a separator from underlying hazardous material. This will permit removal of additional sediment rather than having it incorporated into the total amount of material requiring later disposal as hazardous material.

#### What did you learn from the burned area survey that will be useful for assessment of new BAER events?

No Response.

What did you learn that will be useful for Assessment/Implementation from a BAER process standpoint?

During large or complicated BAER assessments, it is especially important to ensure that conflicts between different prescriptions for the same site are reviewed to avoid duplication or conflicting results.

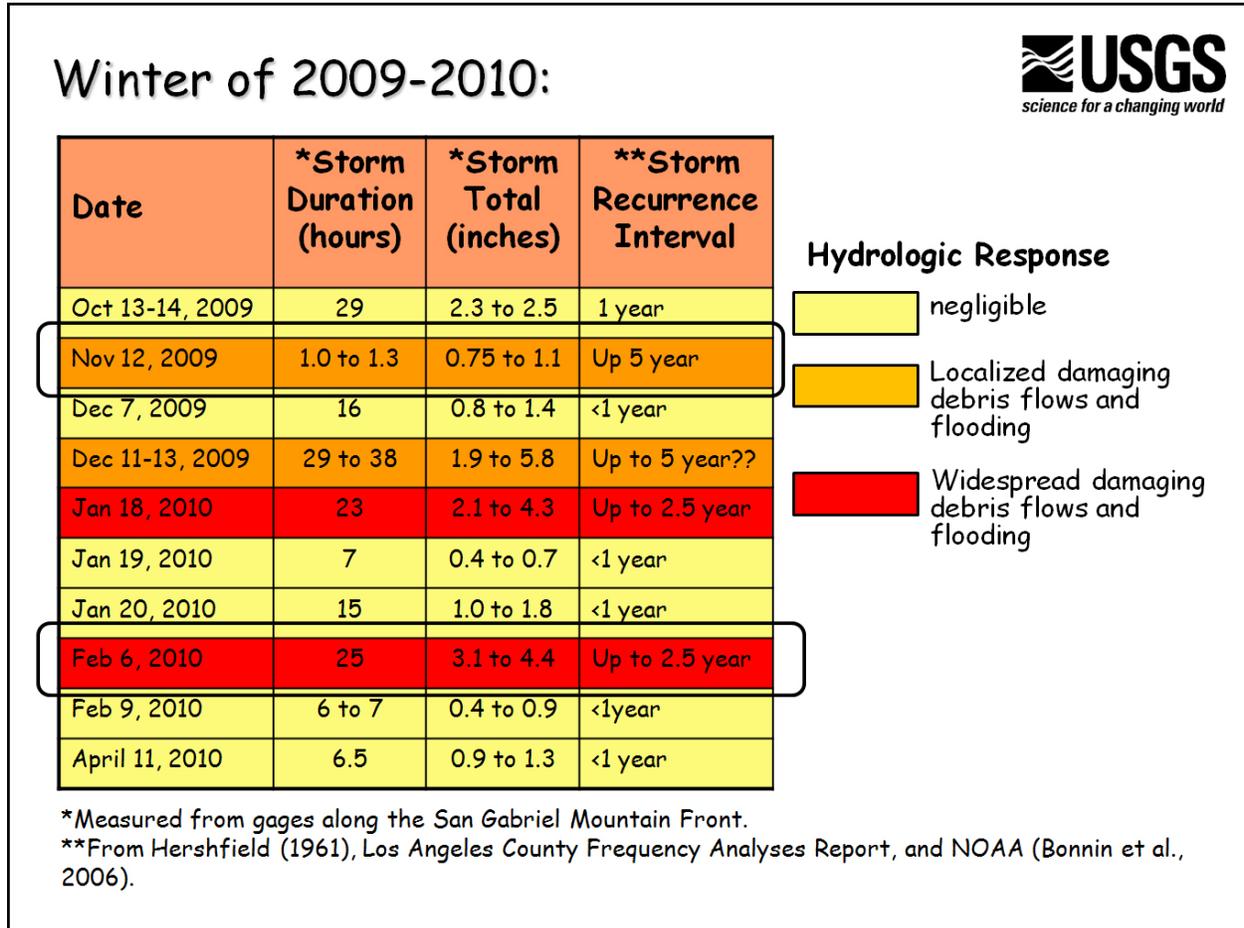


Figure G1: Table showing the details of storm events and their response.



**Figure G2: View from debris source area along k-rails to deposition area at Monte Cristo Fire Station.**



**Figure G3: View of slopes along Arroyo Seco. Drainage network shows 1st order channels effectively scoured to bedrock.**

### Resource: Soils

*Authors and Home Units: Dave Young – North Zone Soil Scientist, Eric Nicita – Eldorado National Forest, Jason Jimenez – Cleveland National Forest*

**Executive Summary:** The first winter over the Station Fire produced massive amounts of soil erosion, as predicted in the original assessment. Virtually all types of erosion were occurring – sheet, rill, gully, debris-flow, in-channel. Sediments were routed out of high gradient channels, and much of this was subsequently deposited in low gradient channels as tributary alluvial fans and braided stream terraces, and is still available for transport next winter with high flow events. A well-formed upland rill and gully network is now in place for more efficient water transport, producing the possibility of flashier and higher flows in the lowlands and lowland stored sediments. Despite obvious vegetative recovery this year, on-site conditions indicate that second-year erosion rates may be similar to first-year; the hazards and risks are still present. Sediment basin capacities should still be expected to be challenged next winter. Higher elevation portions of the fire in the snow zone had very little surface and rill erosion. Hydrophobicity is still present and rather severe in much of the burn area, but then again the original assessment showed that unburned areas were similar and only somewhat exacerbated by the fire. However, water repellency did have some apparent influence on rilling initiation and depth of rills on upland soils lacking cover. Soils

with different parent materials do have somewhat different erosion processes and mobilized materials, as seen at the Monte Cristo Station (white rock and soils) versus different areas. From observation of active hillslope erosion processes, it was agreed that hillslope treatments would have been ineffective, and the soil scientists substantiate the decision of no hillslope treatments as warranted and appropriate in this particular kind of terrain.

### **Original Assessment, VARs, predictions**

During the 2009 Assessment, no emergency determination was made regarding on-site soil resources. Fuels loadings in the chaparral ecotype were considered within 'normal' ranges; soil burn severity was 11% high and 62% moderate. Water repellency was present throughout the fire area, including unburned areas, and did not appear to be greatly exacerbated by the fire. Cyclical fire here is a very natural occurrence, and post-fire pulse erosion is a dominant long-term geomorphic process in this mountain region, influenced also by rapid orographic uplift. Regardless of no soil emergency, we predicted that we would have high rates of soil erosion with dry ravel and debris flow processes being dominant. This would lead to sediment delivery to channels, bulking of streamflows, and contribution of massive source materials for debris flows; these occurrences would pose high potential threats to downstream VARs, including human life and property. General land treatments were not proposed however, as the great majority of erosion source areas are untreatable – being too steep with ravel hillslope processes dominating. Despite these fire and post-fire processes being natural in this region, the large spatial scale of the fire was not typical, affecting many watersheds and downstream municipalities concurrently.

### **What happened with soils during the 1<sup>st</sup> winter of 2009-2010?**

The Revisit allowed an opportunity to see the current erosion processes and compare to predicted and modeled erosion completed during the assessment. The geomorphic processes were in the range that was predicted during the assessment, with localized areas being over- or under-estimated in terms of erosion that occurred. While many of the areas show significant growth of herbaceous vegetation and visually significant greening of the landscape, closer inspection indicates that hillslope sediments are still available and easily mobilized. Overall significant rill and gully erosion has occurred, creating preferential flow paths high in the watershed as well as depositing additional sediment into channels where it can easily be mobilized. Ravel processes are observed to be somewhat reduced in volumes from immediately post-fire, but still a very active process. Informal surveys indicate little reduction in water repellency, presenting an ongoing contributing factor. These factors combine to indicate erosion rates in the coming winter could be as much or possibly greater than the winter immediately post-fire, depending of course on size and frequency of storm events; the potential hazards and risks are still present.

Several significant observations were made during our BAER revisit. We observed that areas within the snow zone did not show significant rill erosion, something that was included in the climate functions of our erosional modeling. We also observed significant differences in watershed response, vegetation recovery, and erosional processes that can be related to the underlying parent materials and subsequent differences in soil characteristics.

The Station Fire occurred in an area that is very active geomorphically. The dominant erosion occurs as ravel and debris flow erosional processes with rill and gully erosion being secondary but significant contributors to the landscape. The ravel and other processes provide continuous source material to the high order channels for subsequent transport with additional rainfall. The absent of soil cover is a main factor in the erosion process, although some recovery (and in places visually significant) of soil cover has occurred, the lack of soil cover will continue until the vegetation recovers to near pre-fire state. Natural geomorphic processes and the above average rainfalls cause the resultant post-fire erosion.

### **Why did it happen?**

The first winter produced several (6-8) substantial storm events, producing high amounts of erosion and sedimentation. While soil erosion was widespread and significant to on- and off-site resources, it was not considered particularly unusual (in an earth science perspective) for this highly active geomorphic region, except in scale of the total area affected at once by a single fire.

### **Recommendations for winter 2010-2011: treatments and treatment maintenance**

The Revisit allowed an opportunity to review our recommendation that hillslope scale land treatments not be done. Observations throughout the fire and above particular VARs confirmed that our recommendation was correct and appropriate. Rilling was initiating extremely high on steep headwall slopes, quickly collecting and transitioning to channel-scour gully erosion and small debris flows. Treatments on lower “treatable” slopes, below already initiated flow energy and material mobilization, would have been overwhelmed and utterly ineffective. Hillslope treatments would not have reduced erosion in any significant manner. Geomorphic processes will continue in the post-fire manner until significant vegetative recovery has occurred.

### **What did the soil scientists learn from the revisit that is useful for new BAER events?**

Woodstraw used for point protection was moved and sorted by wind. While woodstraw is generally acknowledged as fairly robust to windy conditions, the potential of Santa Ana winds to transport woodstraw should be carefully considered.

As a BAER participant from a forest with contrasting soils, topography and climate, the revisit was invaluable for evaluating how different local soils respond after fire. Southern California chaparral, and particularly ravel dominated terrain, is a somewhat unique ecosystem type. The post-assessment evaluation really bolsters understanding of the systems, and lends invaluable experience and credibility to ad-hoc BAER members from different home-unit ecotypes.

Specifically for the San Gabriel Mountain range (and similar topography characterized by extreme slopes and ravel/debris flow dominated processes) the appropriateness of using sheet/rill erosion targeted modeling should be carefully considered. It is unknown how well the absolute values derived using the ERMiT model relate to actual sediment production the first winter; however, a critique of the model’s outputs will be possible thanks to Sue Cannon’s work, and several models will be compared post-hoc when measured sediment production data becomes available shortly. A sediment rate map was created but was not necessarily used for assessment or evaluating VARs. While the accuracy and validity of using

this model in this location was questioned during the original assessment, it was still considered a desirable exercise to at least get a relative representation of sediment production for identifying and prioritizing hazard source areas.

Several days were devoted on the Station Fire for the erosion modeling. Given uncertainties with the available models, perhaps the time could have been more appropriately spent on the ground validating soil burn severity, describing soil properties and how they influence types and magnitude of erosions, developing a better understanding of geology and soil relationships, and getting more data on hydrophobicity. It is clear that our knowledge of the role hydrophobicity plays in post-burn soil hydrologic function and ecologic recovery is still largely unknown. We need to review and develop a better understanding of hydrophobicity in this and other fire-prone areas.

**What did we learn that is useful in terms of the Assessment/Implementation BAER process?**

**Treatment database:** A regional treatment database would be helpful for those BAER personnel without decades of experience. This database could be populated during the assessment, during implementation, and after any reviews of treatment effectiveness. Such a database could include treatment descriptions, cost estimates, diagrams or photos, actual costs, contractors used, and whether the treatment was a success.

**Revisits:** The process of the fire revisit was absolutely invaluable for understanding ecotype and verifying or modifying assumptions used in the rapid assessment process. This should be considered more frequently, particularly for large and complex incidents. Although it would be cost prohibitive to regularly hold revisits with all personnel involved, costs could be controlled by holding them with only resource leads.

**Resource: Hydrology**

**Authors and Home Units:** *Tim Biddinger, BAER Hydrologist, Tahoe National Forest, Chris Stewart, BAER Hydrologist, Sequoia National Forest, Kyle Wright, BAER Hydrologist, Sequoia National Forest*

**Executive Summary:** This report documents the findings from the Station Fire revisit in May 2010, which was conducted following the first winter post fire. Field visits to various locations within the fire area showed that most first and second order streams displayed signs of rill and gully networks. In many cases these rills and gullies are scoured down to bedrock. Stream channel deposition and stored sediment is very apparent in larger order streams down slope. Debris basins along communities in the front country were cleaned out on a regular basis by Los Angeles County Public Works following storms this winter. One debris basin above La Canada did over-top this last winter resulting in several structures being damaged. Vegetative recovery is ongoing and much greater along the front country. This recovery will not significantly reduce risks from the burn area over the 2010-2011 winter or if thunderstorms occur this summer and fall.

### **Values at Risk (VAR), Threats and Predictions to Resource Area**

The table attached identifies the values at risk in the primary watersheds (HUC 4) of the Station Fire, which were identified during the initial assessment. The primary threat to the values at risk is flooding and sedimentation. Mobilization of woody debris, stored sediment, and refuse within stream channels is an additional threat in areas of stream constriction where debris can build up with sediment and spread floodwaters and debris flows into residential and urban areas. The primary treatment was to close the fire area in order to mitigate the hazard to life and property. Broad landscape scale treatments were deemed ineffective in reducing hazards to the values at risk. If such treatments were to occur, they would have provided a false sense of security to the public.

### **Winter of 2009 – 2010**

During the winter of 2009 – 2010 landscape scale effects occurred as a result of the winter storms. The most noticeable effects on water quality were, increases in sediment and ash from the burned area into waterbodies in and downstream of the fire area. During storm events, this increased turbidity and contributed to pool filling. Ash was also an impact to water quality and public health. Natural recovery was the recommended treatment.

### **Recommendations for the winter of 2010-2011**

Threats to the water resources will be the most acute during the first and second post-fire rainy seasons from October through March. The threats to the water resources will begin to decline over the following three to five years as the hillslopes begins to revegetate. The public needs to be continually educated on the risks from the fire area. Flooding and debris flows in high-use areas, such as Arroyo Seco Canyon and Big Tujunga Canyon, still pose a significant threat to life and property. It is not recommended to open up Arroyo Seco Canyon or Big Tujunga Canyon until proper infrastructure and hazards are evaluated by an interdisciplinary team. Continued Forest Service involvement with the coordinated agency recovery effort (CARE) is recommended. Coordinate with the City of Pasadena for the construction work being completed in the mouth of the Arroyo Seco Canyon. It is recommended that the forest continue its cooperation with the Riverside Fire Lab and USGS with their studies of the fire area.

### **Lessons Learned**

The Station Fire provided an opportunity to have multiple agencies conduct studies on the fire area to help with our analysis on future fires. One of the preliminary findings was that ten minute rainfall intensity was the triggering event that caused peak flows. This presents a problem because the national weather service does not provide information for storm intensities under one hour.

**Watershed Related Values at Risk in the watersheds of the Station Fire**

Watersheds (HUC 4 Watersheds: HUC 6 Watersheds)	Values at Risk from Flooding and Sedimentation	Comments
Los Angeles River: Pacoima Wash, Lower Big Tujunga Canyon, Middle Big Tujunga Canyon, Upper Big Tujunga Canyon, Verdugo Wash, Arroyo Seco Creek, and Eaton Wash.	Private Residences, outbuildings, farms and ranches, roads, debris basins, and other infrastructure are subject to flooding and sediment deposition as a result of post-fire watershed response. Temporary impacts to water quality from ash and sediment. Big Tujunga Reservoir, Pacoima Reservoir, and domestic water supply. Potential loss of human life as a result of major flooding and debris flows.	With the expected increases of sediment and runoff during large storms post-fire from the burned watersheds, channel sections in lower gradient stream reaches have the potential to accumulate excess sediment and debris deposition that could cause peak flows to overwhelm channels and debris basins and flood adjacent areas and streamside terraces.
San Gabriel River: Upper West Fork San Gabriel River and Middle West Fork San Gabriel River	Roads, Cogeswell Reservoir, and other infrastructure are subject to flooding and sediment deposition as a result of post-fire watershed response. Temporary impacts to water quality from ash and sediment. Potential loss of human life as a result of major flooding and debris flows.	With the expected increases of sediment and runoff during large storms post-fire from the burned watersheds, channel sections in lower gradient stream reaches have the potential to accumulate excess sediment and debris deposition that could cause peak flows to overwhelm channels and flood adjacent areas and streamside terraces.
Antelope-Fremont Valleys: Little Rock Reservoir and Little Rock Creek	Roads, Little Rock Reservoir, and other infrastructure are subject to flooding and sediment deposition as a result of post-fire watershed response. Temporary impacts to water quality from ash and sediment. Potential loss of human life as a result of major flooding and debris flows.	With the expected increases of sediment and runoff during large storms post-fire from the burned watersheds, channel sections in lower gradient stream reaches have the potential to accumulate excess sediment and debris deposition that could cause peak flows to overwhelm channels and flood adjacent areas and streamside terraces.
Santa Clara River: Aliso Canyon, Soledad Canyon-Arrastre Canyon, and Lower Soledad Canyon	Private Residences, outbuildings, farms and ranches, roads, and other infrastructure are subject to flooding and sediment deposition as a result of post-fire watershed response. Temporary impacts to water quality from ash and sediment. Potential loss of human life as a result of major flooding and debris flows.	With the expected increases of sediment and runoff during large storms post-fire from the burned watersheds, channel sections in lower gradient stream reaches have the potential to accumulate excess sediment and debris deposition that could cause peak flows to overwhelm channels and flood adjacent areas and streamside terraces.

**Resource: Wildlife and Fisheries**

*Authors and Home Units: Leslie Welch (Angeles NF), Dan Teater (Tahoe NF) Date: May 13, 2010*

**Executive Summary:** The BAER Report for wildlife and fish identified Values at Risk that included USFWS threatened/endangered species and Forest Service Sensitive species and their associated habitats. It was predicted that post-fire events would lead to modification of suitable habitat and have the potential to result in direct injury/mortality of individuals. Habitats most at risk included streams occupied by arroyo toad, mountain yellow-legged frog, California red-legged frog, Santa Ana sucker, Santa Ana speckled dace and arroyo chub.

Recommendations for management of special status aquatic species were developed as the result of interagency collaborations that included US Fish and Wildlife Service, USGS and California Department of Fish and Game. The BAER hydrology report was relied upon heavily to determine the level of risk for extirpation or reduced viability of native fish and amphibian occurrences in Big Tujunga Canyon, Devil’s

Canyon, Aliso Canyon and Soledad. Based upon predicted sediment and debris flows and potential for flushing flows, decisions were made to salvage native fish from Big Tujunga Creek and mountain yellow-legged frog tadpoles from Devil's Canyon.

Area closures were considered an important tool for protection of TEPS populations and sensitive habitats. Closures would facilitate vegetative recovery, reduce illegal OHV use and reduce recreation impacts to special status populations and their habitats. Monitoring has confirmed the effectiveness of closures in providing protection to special status populations and their habitats. Prior to lifting area closures, evaluation is needed to determine if adequate vegetative recovery has occurred.

Stream conditions have not stabilized and it is expected that concerns regarding special status aquatic species viability and their habitat will persist for the next 2-4 years. Monitoring and close collaboration with interagency partners will be essential in the development of future recommendations for habitat and special status species management.

**VAR, Threat and Risk to Resource area? What did you predict would happen?**

The following USFWS threatened/endangered species are known from in/near the fire area: least Bell's vireo, California gnatcatcher, California condor, Santa Ana sucker, arroyo toad, mountain yellow-legged frog, California red-legged frog, unarmored three-spine stickleback. The following FS Sensitive species are known from in/near the fire area: Santa Ana speckled dace, arroyo chub, western pond turtle, two-striped garter snake, San Diego horned lizard, coastal rosy boa, San Bernardino mountain kingsnake, San Bernardino ringneck snake, California legless lizard, Nelson's bighorn sheep, peregrine falcon, California spotted owl, western red bat and pallid bat.

For aquatic species, the following threats were identified: reduced water quality and changes in water chemistry due to ash delivery, hazardous materials, and changes in water temperature from loss of canopy shading; scouring of riparian/aquatic vegetation and changes in streambed/pool habitat due to debris flows and sediment delivery; flushing of species during flood events downstream and the potential for localized extirpations due to barriers that prevent re-colonization. It was predicted that post-fire conditions could lead to the extirpation of small and isolated populations. Larger populations with more widespread distributions could experience short term impacts, but would be expected to recover over time.

For all wildlife habitats and species, the following threats were identified: long-term disturbance and habitat impacts from increased access by people and OHVs. For all species, the concern was that until enough vegetative recovery (3-5 years or longer) has occurred to deter off-road vehicle use, habitat degradation may occur. Increased access and visibility due to lack of vegetative cover could result in habitat degradation, disturbance of species, and increased risk of collection for species such as turtles, frogs and fish. The spread of non-native plants and animals into rare species and general wildlife habitat was also identified as a concern.

**What happened during the winter of 2009/10 in regard to your resource or facility (Findings)?**

In response to the predicted post-fire impacts to species and their habitats, the following treatments were proposed: area closures, species salvage, micro-trash removal, parking management and off-channel pond creation.

Area closures were proposed to allow for vegetative recovery and it was expected that a minimum of 3-5 years would be needed for this initial and critical phase of post-fire recovery. The recommendation included analysis of the success and effectiveness of the closure after three years. Initial observations indicate that the closure has been successful in reducing recreation use in areas occupied by Santa Ana sucker and arroyo toads. Site visits have documented very little recreation use at the upper Big Tujunga arroyo toad occurrence. While some recreation use has been occurring in the lower Big Tujunga area, it has not resulted in large accumulations of garbage, widespread recreational dam construction or vegetation trampling.

Of the recommended treatments, species salvage was the most time sensitive and required the greatest amount of interagency coordination. The decision to salvage Santa Ana sucker, Santa Ana speckled dace and arroyo chub was an interagency decision that involved USFS, USGS, USFWS, CDFG and other local species experts. A total of 290 Santa Ana suckers, 35 Santa Ana speckled dace and 30 arroyo chub were salvaged in October 2009 and placed at the Riverside Corona Resource Conservation District facility. The salvaged fish will remain at this facility until the regulatory agencies determine that it is appropriate to return them to Big Tujunga Creek. A salvage of 106 mountain yellow-legged frog tadpoles was implemented at the Devil's Canyon site. This effort was coordinated with the USFWS, CDFG and USFS. USGS implemented the salvage and although information and analysis from the BAER team was instrumental in reaching a decision to remove tadpoles, no BAER funds were used for this effort. The final disposition of the salvaged fish and mountain yellow-legged frogs has not yet been determined.

Efforts were made to coordinate with LA County for the installation of earthen berms along the Upper Big Tujunga Canyon Road. Due to new regulations that restrict placement of structures within 10 feet of the fog line, LA County is unable to comply with the FS request for installation of berms. As a result, the original proposal to manage parking through physical barriers cannot be implemented. Management of parking will rely on signs that prohibit parking in the target area. Additional patrol of this area will be needed to ensure compliance with the no parking zones and any existing closure.

For microtrash removal, it was determined that no clean-up efforts were needed at the Mt. Gleason communication site. Removal of microtrash at Mt. Lukens and Magic Mountain will be implemented during the summer of 2010. To allow rain induced erosion to expose additional materials for clean-up, a decision was made to postpone clean-up efforts until the 2010 rainy season was over. There has been no post-fire condor use documented at either Mt. Lukens or Magic Mountain.

A population of California red-legged frogs was discovered in Aliso Creek after the Station Fire. Initially, no treatments were recommended for this occurrence. When USGS surveyed Aliso Creek on 2/2/10, they documented drastically reduced pool capacity and reduced habitat suitability for California

red-legged frogs. In response, CDFG, USFWS, USGS and FS collectively recommended the creation of off-channel ponds to provide suitable habitat for egg laying and tadpole rearing. The Forest designed and implemented a project that resulted in the creation of six pools in close proximity of the stream. Occupancy of these ponds by California red-legged frogs has been confirmed.

In areas occupied by TES species including arroyo toad, California red-legged frog, mountain yellow-legged frog, western pond turtle, Santa Ana sucker, arroyo chub, and Santa Ana speckled dace, stream habitat was heavily modified by high flows and sediment loads. Stream response included high amounts of sediment deposition in pools and along streambanks. Many historic pools are now filled with sediment to the extent that capacity is greatly reduced. In some areas, the stream channel has become braided or the active channel has shifted to a new location. This has resulted in more riffle habitat than was present prior to the fire.

Species such as the California red-legged frog, western pond turtle, Santa Ana sucker, arroyo chub, and Santa Ana speckled dace utilize ponds seasonally for refuge and reproduction. The reduction in deep pool habitat has decreased availability of this important habitat component. In Aliso Canyon, USGS documented the loss of 100% of the existing pools in the stream stretch occupied by California red-legged frogs. In upper Big Tujunga Canyon, deep pools that previously supported western pond turtles have been completely eliminated. In lower Big Tujunga Canyon, deep permanent pools that were previously identified as important refugia for Santa Ana sucker are now filled with sediment at levels greater than 50% capacity. For these species, the loss of pool habitat suitability may result in decreased reproductive success or viability. Due to current water conditions, monitoring of fish populations in Big Tujunga Creek has not yet occurred. Surveys to document fish distribution and abundance are scheduled to start as soon as stream conditions allow (approximately June-July 2010).

For the arroyo toad, there has been an increase in the amount of sandy beach areas and gravel stream bottoms in areas historically occupied by this species. Where these conditions occur in association with slower water flows, there has been an increase in the amount of habitat suitable for egg laying and tadpole rearing. Arroyo toads have already been documented in historically occupied areas within the burn area. No expansion of arroyo toad distribution has been documented yet.

The Devil's Canyon mountain yellow-legged frog occurrence has not been monitored post-fire. Monitoring of this site will commence in June 2010.

### **Why did it happen?**

As predicted, post-fire events modified stream habitat and led to an overall decrease in deep pool habitat. This is the result of high amounts of stream aggradation without subsequent flushing flows to move material out of the system.

### **Recommendations for next winter (2010/2011) I.E. is additional treatment needed? Do treatments need maintenance?**

1. Monitor and evaluate burned to determine if conditions are appropriate for lifting temporary closures. If the necessary evaluation has not been completed or if it is determined that post-fire recovery will be negatively impacted, keep current closures in place.

2. Monitor California red-legged frog ponds to determine if they are retaining water and suitable conditions for adults and tadpoles. Implement additional treatments if warranted. Potential treatments may include deepening of pools or creation of new pools.
3. Monitor arroyo toad habitat to document if recreation use is occurring. Document if recreation use is impacting habitat or individuals. Coordinate with LA County to install additional “No Parking” signs along the Upper Big Tujunga Canyon Road between Mile Markers 2.35 and 4.65. Install additional signs to direct recreation use away from the stream. Increase patrol of the area and enforcement of the No Parking zone and closure. Implement appropriate treatments if it is determined that existing measures are not effective.
4. Monitor the Devil’s Canyon mountain yellow-legged frog site to assess habitat conditions. Determine if any treatments are needed. Potential treatments may include restoration of the pools or removal of invasive plants.
5. Monitor Santa Ana sucker, arroyo chub and Santa Ana speckled dace habitat to assess habitat conditions and population status. Coordinate with CDFG and USFWS regarding survey efforts. Utilize survey results to make recommendations regarding the release of salvaged fish back into Big Tujunga Creek. Monitor stream conditions to determine when uses such as recreation can occur without compromising stream recovery. Work cooperatively with CDFG and USFWS to develop a plan outlining the reintroduction strategy for salvaged fish back into Big Tujunga Creek.
6. Continue micro-trash removal at selected sites. Areas lacking vegetation are subject to accelerated erosion and will continue to experience increased exposure of buried micro-trash.

**What did you learn from the burned area survey that will be useful for assessment of new BAER events?**

1. Treatments such as the construction of off-channel pools can be highly effective in creating suitable habitat for aquatic species such as the California red-legged frog.
2. Species salvage can be beneficial and appropriate, but is not warranted for all species or in response to all fire events.
3. Determining the appropriate length for closure can be difficult to identify and requires an interdisciplinary approach.
4. Regular monitoring of populations and habitat conditions within all occupied and suitable habitats will give biologists a stronger grasp of the year to year status and needs within each of the suitable watersheds in the fire. This will allow managers to be better prepared to respond to emergencies and guide non-emergency restoration and reintroduction efforts.
5. Successful species salvage requires the following: an interagency approach, approved facilities for holding individuals and a strategy for the reintroduction of salvaged individuals.

**What did you learn that will be useful for Assessment/Implementation from a BAER process standpoint?**

Availability of crews limits feasibility of implementing adequate patrols and enforcement. This is critical where closure is identified as a primary means of resource protection.

**Please summarize your results in the table below:**

Resource Area	VAR	Threat (Debris Flow, Soil Erosion, etc.)	Risk (H,M,L)	Action Taken (Treatment)	What Happened? (Findings)	Recommendations (Winter 10/11)	Lessons Learned
Wildlife	Big Tujunga Creek	Bank destabilization, loss of pool habitat, water quality	H	Monitoring, species salvage, area closure	Area closure protected stream resources from user impacts. Native fish were removed from sites and protected from post-fire effects until re-introduction occurs.	Continue closure in areas where species and habitat are at risk from impacts associated with visitor uses. Continue monitoring.	Closure has helped facilitate site recovery. Species salvage is most warranted for species with very low numbers, limited distribution and very specific habitat features likely to be lost during post-fire events.
	Aliso Creek	Loss of pool habitat	H	Monitoring, pool creation, area closure	Area closure protected stream resources from user impacts. CRLF are using the off channel pools created by FS	Continue closure in areas where species and habitat are at risk from impacts associated with visitor uses. Continue monitoring.	Closure has helped facilitate recovery. Artificial pools can successfully provide temporary habitat

**Resource: Non-Motorized Trails – Recreation and Watershed**

*Authors and Home Unit: Casey Shannon, Watershed - Inyo National Forest*

**Executive Summary:** Trails in the Station Fire were identified for BAER treatments by the Station Fire BAER assessment team. During early November 2009, Casey Shannon completed a brief field and map exercise to identify and prioritize trail sections for treatments. A map was developed showing identified trails. The Ranger District identified trails for priority. The method used to select trails for treatment was to consider trails within areas of moderate and high burn severity that had a gradient of 10% or greater that had a capacity to collect runoff from adjacent slopes with even greater slope angle. There was no comprehensive ground survey completed at the time due to lateness of the season and the upcoming winter storm season. A trail crew was brought in to do the treatments from the Stanislaus National Forest and completed a portion of the work for the identified trails. The crew worked on the Gabrieleno trail below Red Box gap, Silver Moccasin trail from Charlton Flat to Big Tujunga Creek, Pacific Crest Trail near Mill Creek saddle and Mount Gleason, and Falls Creek Trail near Singing Springs.

During the week of May 2-9, 2010, Casey Shannon joined with Andrew Fish, Angeles NF Trails coordinator to conduct intensive ground surveys of the identified trails for additional BAER treatments. We surveyed the following trails: Gabrieleno Trail (Switzer camp to Altadena and Red Box Gap to

Switzer camp), Strawberry trail (from Highway 2 to Colby trailhead) Pacific Crest Trail (Pacifico Mountain to Mill Creek summit and PCT section 1 mile north of North Fork Station) and the Silver Moccasin trail (Charlton Flat to Shortcut saddle). Surveys showed that a large portion of the trail sections were un-tread able due to large amounts of sediment and debris that have overwhelmed the trail bench cut, streams xings that have severely incised (wash out), slope failure where tread is missing and where trails follow stream courses have been washed out completely by floods. Some portions to a lesser amount were still intact that BAER treatments are still feasible. It appears that several sections of the trails surveyed will need to be reconstructed or have heavy trail maintenance done and need to be considered for long term restoration planning. BAER treatments completed on the Silver Moccasin trail were successful and helped to prevent severe trail degradation. In summary, there is still a need to complete additional BAER treatments on identified trails and to complete maintenance on treatments completed previously. Trails found to be destroyed or heavily impacted will need to be considered for long term restoration and are not applicable for BAER treatments. It is advised with the more unstable trails reconstruction may be premature and lead to failure if undertaken before watershed conditions stabilize over the next 2-3 years, and in some instances re-routes may be necessary for sustainable trails over the long term that will require further study and analysis.

**VAR, Threat and Risk to Resource area? What did you predict would happen? Were BAER treatments prescribed and implemented to protect your Resource?**

Non-Motorized Trails (property and infrastructure) and watershed stability were considered as Values at Risk. It was predicted that if trails were not stabilized with water control treatments a higher degree of trail loss and associated slope erosion would occur. BAER treatments were prescribed and implemented but were not completed to full prescription. There was no technical supervision on the ground during implementation which caused the work to not be completed to prescription as priorities and outcome of work was not communicated effectively to work crews and if done so would have likely lead to a higher rate of treatment success and cost efficiency as well. This is not to say the trail crews were incompetent, but with better oversight productivity would likely have been increased.

**What happened during the winter of 2009/10 in regard to your resource or facility (Findings)?**

Major rain events during the winter months with short duration, high intensity precipitation occurred when burned watershed conditions were most vulnerable caused severe erosion to trails aligned on steep slopes or adjacent to large stream channels. Large amounts of soil and debris deposits off steep slopes overwhelmed trail tread for long distances to the point where there are no longer can be safely tread upon. There was some success with a smaller percentage of trails treated and proved to be worthwhile, but a large majority of the trails within the fire area sustained major damage and in some cases complete loss of trail tread and trail stream crossings were deeply incised or carried water onto the trails causing additional trail erosion and loss.

### **Why did it happen?**

The nature of the rain events coupled with the highly unstable watershed/geologic conditions in the fire area caused the severe trail impacts and in most instances BAER treatments would only have a minimal beneficial effect with this scenario. The storms that occurred this winter season were not extreme but strong enough to cause a high watershed response due to the fire conditions. The scenario would have been far worse if storms of an unusually intense and repetitive nature occurred as can happen in the San Gabriel Mountains.

### **Recommendations for next winter (2010/2011) i.e. is additional treatment needed? Do treatments need maintenance?**

Complete additional trail evaluations on priority trails to identify where additional BAER treatments would be useful and implement treatments in a timely fashion before the next winter rain season occurs. Maintain treatments that were effectively completed previously for efficiency. Monitor treatments after storms and identify additional maintenance needs. It is recommended an experienced trail specialist or watershed specialist oversight to crews during planning and implementation. If trail sections are found during surveys destroyed or are not feasible for BAER treatments (i.e., overwhelmed with abundant sediment of debris or in a highly unstable area), list needs and inventory trails for long term restoration planning.

### **What did you learn that will be useful for assessment of new BAER events?**

Pre-work or planning for BAER trail treatments before actual implementation in terms of location and site suitability and to provide technical oversight pre-work layout and with implementation crews will increase success of BAER treatments. Assessment teams need to figure into cost analysis for this to done as it is not feasible to conduct pre-implementation ground work for trails treatments due to time constraints. It is also important to include Forest recreation and trails personnel with the BAER assessment team to provide specific information on trail conditions and areas to help determine where trail treatments are needed and to understand logistics that will help with cost estimates.

Please summarize your results in the table below:

Resource Area	VAR	Threat (Debris Flow, Soil Erosion, etc.)	Risk (H,M, L)	Action Taken (Treatment)	What Happened? (Findings)	Recommendations	Lessons Learned
Recreation and Watershed	Non-Motorized Trails and watershed stability	Severe trail erosion and loss of trail footprint	High	Water bars to control concentration of runoff on trail sections	Some success in stabilizing some trails, a large amount of the treated trails sustained severe damage to complete loss of trail tread.	Complete additional surveys of trails not previously surveyed and determine treatment needs and feasibility and implement treatments. Provide oversight for treatment implementation by experienced trails specialist or watershed specialist.	Complete on the ground trail assessments if possible before implementation to place treatments where most needed and where they will be efficient. Provide technical oversight to implementation crews to ensure prescription is followed.

**Resource: Heritage**

*Authors and Home Unit: David Peebles – ANF, Nolan Smith – TNF, Darrell Vance – ANF*

**Executive Summary:** Wildfires have the potential to damage, or destroy cultural resources through: (1) direct effects of the intense heat and smoke; (2) ground disturbing rehabilitation measures; and/ or (3) soil movement caused by subsequent storm episodes. These impacts may completely destroy historic and archaeological resources or alter the context of surface and subsurface cultural remains important to scientific analysis and interpretation. Also, fires may increase the accessibility and visibility of archaeological site locations, creating a heightened susceptibility to vandalism, artifact looting, and unauthorized Off-Highway Vehicle (OHV) activity.

The Station Fire BAER Heritage measures were proposed at five prehistoric sites. Proposed treatment measures included alteration of runoff channels at specific locations; placement of energy dissipating devices in road drainages; the scattering of seed and straw mulch to promote re-vegetation; and the erection of barriers to exclude people and vehicles from sensitive areas. The onset of winter precipitation immediately subsequent to the wildfire caused significant access issues that precluded the implementation of some proposed Heritage treatments. Upon later assessment, however, the proposed treatments may have either proved ineffective or unnecessary, as the resultant effects were found to be relatively minor. Further measures to be proposed focus on signage and monitoring, and minor treatment maintenance.

**Values at Risk**

**FS # 05015100095:** The site consists of prehistoric midden deposits, thermal features, and a surface artifact scatter at the confluence of Mill creek and an unnamed drainage west of Granite Mtn. The site is bisected by Forest Road 4N18.

The proposed treatment of this site consisted of the creation of a rolling dip on FR 4N18 to redirect water flow away from a site feature. Prior to construction/implementation, augering of the rolling dip placement area was performed to ensure that subsurface deposits would not be impacted. The proposed treatment was not implemented, due to winter storms and access issues.

It has been subsequently determined that the proposed treatment would not be effective, and that most of the drainage issues may have been pre-existing. The winter precipitation has caused some rilling through the center of the road, but there does not appear to be an effective treatment that would prevent further effects to the site. Moreover, this is a Southern California Edison-permitted road, and site management appears to fall under a Section 106 Programmatic Agreement involved in a current transmission line project. **No further treatment measures are proposed.**

**FS#05015500032:** The site is part of a NRHP eligible rock art district and consists of cupule boulder rock art and a large lithic scatter. The site is bisected by Aliso Canyon Road (LA County) and is easily accessible. The boulders with the cupule rock art are small, easily visible, and at-risk for theft and vandalism. The site has been vandalized in the past. The proposed treatment consisted of seeding and wood straw mulching the site in order to accelerate vegetative re-growth and aid in obscuring exposed artifacts and features from view. Native seed was collected from the local area by botanists and then hand scattered across the site. Wood straw was subsequently hand applied to the site to stabilize the seeds until germination.

Winter precipitation has caused minor sheetwash and rilling on the site, and associated minor clumping of seed and wood straw. There are signs of re-growth of chaparral species from the seed (approximately 2" height), but these are largely subsumed by surrounding foot-high wildflowers over the entire landscape (including untreated areas).

The short-term benefits of the treatment were not realized – during the immediate post-burn period of visibility, the site was covered with the very visible treatment which may have served as an attractant rather than a screen. The wood straw will also hamper Forest-sanctioned activities on-site in the near future, as the rate at which wood straw deteriorates is a major factor in visibility. Moreover, the mid-term and long-term effects are unclear; regrowth on-site has occurred at the same rate as the untreated areas nearby. The small sprouts that are appearing are sage and juniper; surrounding vegetation type is largely chamise. It is possible that the area will fill in and even out, and the treatment may still prove effective over time.

It is also noted that there was significant lag between the original seeding and the emplacement of the wood straw (two or more weeks), during which time one or more precipitation events fell. It is unclear what effect those events may have had on the destabilization of the seed deposits. During the implementation, experimental test plots and controls could have easily been implemented to gauge effectiveness and inform the record for future use of the treatment. **Future measures proposed for the site include a discussion of “No Parking” signs along the County road, and continued monitoring for vandalism and trespass.**

**FS#05015500042:** The site consists of a prehistoric scatter of groundstone and lithic artifacts. The site is bisected obliquely by FR 3N17. The purpose of treatment was to minimize post-fire runoff from

increased channelization through the archaeological site and by doing so, protect artifacts and subsurface features from erosion, exposure, and theft. The proposed treatment of this site originally consisted of the creation of two rolling dips to redirect water flow away from this site, berming road access along FR 3N17, and placing straw wattles to slow water velocity within channels. Also proposed was deposition of wood straw mulch to provide ground cover for returning vegetation.

Prior to construction/implementation, augering of the rolling dip placement area was performed to ensure that subsurface deposits would not be impacted. One of the two rolling dips was eliminated due to its perceived lack of effectiveness. The second rolling dip and the wood straw mulch were not subsequently implemented, due to winter storms and access issues. Approximately 11 straw wattle check dams were emplaced in the drainage parallel to 3N17.

There appears to have been moderate rilling in the road, and flow through site deposits in the location of the proposed second rolling dip. If the dip had been emplaced, it would have continued to channel flow into site deposits; conversely it may need to be remedied by inserting an overside drainage flume. There was one noticeable erosion channel off the embankment, but it had been treated by laying slash in the channel. The wood straw deposition proved to not have been needed as-yet; horizontal displacement of site materials has not occurred, and Santa Clara Divide is under area closure preventing trespass and non-administrative vehicle use of the area. The wattle check dams completely silted in, and appear to have been partially overwhelmed. This treatment has proven effective, but has reached its limit. **Maintenance of the straw wattle structures or improvement through hay bales and downed slash dispersers is recommended. It is also recommended that when 3N17 is opened to public use, a small OHV barrier on the road edge be improved.**

**FS # 05015500163:** This site consists of several discrete prehistoric thermal features (or earth ovens) within the road prism of Forest Road 4N24. It was expected that post-fire conditions would lead to increased runoff and redirect water into the site. The proposed treatment consisted of mechanical removal of accumulated sediment along a 200ft section of the road. The proposed treatment was not subsequently implemented, due to winter storms and access issues.

The winter precipitation has caused sediment movement across the road; the runoff has not proved to have been much effect to the site constituents. It has been subsequently determined that the proposed treatment would not be effective, and that most of the drainage issues were pre-existing. Moreover, this is a Southern California Edison-permitted road, and site management appears to fall under a Section 106 Programmatic Agreement involved in a current transmission line project. **No further treatment measures are proposed.**

**FS# 05015100011:** A number of NRHP-eligible prehistoric sites lie in the Upper Big Tujunga Drainage, and have been burned over and exposed to looting and vandalism by the fire. Most of the sites lie in relative proximity to the creek.

Heritage combined with the Wildlife treatment to propose installation of physical barriers to prevent parking along a 2.5 mile stretch of the Big Tujunga Canyon Road, in order to reduce the potential for damage to occupied arroyo toad habitat and protect the cultural sites. Earthen berms were recommended for barriers, but this has proven to be against LA County regulations (they are required to leave an

emergency shoulder free). “No Parking” signs were installed at 50-meter intervals to keep the public moving through the area. **Further treatments include the installation of additional signs to advise the public of sensitive resource protection needs along the length of the road, as well as enforcement monitoring.**

Resource Area	VAR	Threat	Risk	Action Taken	Findings	Recommendations	Lessons Learned
Heritage	FS# 05015100095	Channelized flow in site	Mod	None, implementation could not be undertaken due to wet road conditions	Could not implement dip. Minor damage	None – SCE TRTP 106 PA site	Prioritize site treatment by accessibility not by Risk Level
	FS# 05015500032	Vandalism, Looting, Erosion	High	Seeding, Wood Straw	Some regrowth, moderately protected	Monitoring, No Parking Signage along road	Treatment timing, questionable effectiveness in short term
	FS# 05015500042	Channelized flow in site, OHV	Mod	Straw waddle checkdams	Could not implement dip. Wattle dams silted in, used up.	Maintain drainage treatment, make larger. Need OHV barrier if reopened for use.	Need larger check dams. Prioritize site treatment by accessibility not by Risk Level
	FS# 05015500163	Channelized flow in site	Mod	None, implementation could not be undertaken due to wet road conditions	Could not implement dip. Minor damage	None – SCE TRTP 106 PA site	Prioritize site treatment by accessibility not by Risk Level
	Upper Big Tujunga Drainage	Vandalism, Looting	High	No Parking Signs installed to discourage site access.	LA County won't berm their roads	More signage, monitoring	The treatment is still being analyzed

### Hazardous Materials

*Author and Home Unit: Joe Gonzales, Hazardous Materials Coordinator, Station BAER Implementation Team Member*

**Executive Summary:** Field observations of Forest Service buildings within the burn perimeter were that buildings had mulching application for Hazardous-Material Stabilization. The hydromulch treatments were prescribed to stabilize toxic materials created (asbestos-containing building materials and lead paint leaching out) and destabilized by the fire. Action taken on twenty five acres of small buildings and two large compound facilities and include two open spaces with hazardous wastes. This work of application of hydromulch as a BAER treatment, met the cover protection objective. Further monitoring of the hydromulch treatment and laboratory testing for amount of hazardous materials is needed. It is determined that the hazardous materials which pose post-fire, health, and safety concerns still exist for 2010/2011.

## Report

Hazardous material treatments include stabilizing or removing toxic materials created (asbestos containing materials burnt up in the fire and high lead levels may now leach out burnt buildings or facilities) or destabilized by the wildfire.

### **The BAER Treatment preference for emergency stabilization of hazardous materials is:**

- Control contamination by in-place isolation by ground application hydromulch and use of chemical absorbent socks for containment measures.
- Twenty five acres of buildings and facilities were completed and include open spaces with hazardous wastes.
- Coordinate stabilization for hazardous materials not under Forest Service jurisdiction, such as special-use cabins.
- Use a qualified COR to manage the R5 Contract for the Contracting Officer.
- Photos taken of hydromulching at each treated site.
- Safety issues (e.g., down electrical cables and lines).
- The LA County Health Hazmat and Forest Hazmat assisted and test of the burnt materials.

### **The BAER Treatment Monitoring Recommendations:**

- Oversight and monitoring (ongoing).
- Retreat with hydromulch of select sites.
- Unstable sediments with hazardous materials on Monte Cristo Fire Station (new waste containment measures).
- Prevent contamination by through site stabilization by ground cover (new treatment)
- Removal of hazardous materials (for example a long-term treatment).
- Team discussion and recommendations for Monte Cristo Hazmat site.

### **The BAER Treatment preference for emergency sewage toilet pumping of human waste is:**

- Special problem of disposal did arise when a tanker-pumper of human waste to such a degree that high concentration of solid (burnt wood and metal debris) or Hazmat developed.
- Amount of sewage and waste water treated (over 2200 gallons).
- Amount of human waste pumped to disposal from 7 sites (over 1000 gallons).
- Gallons of clean water (moisture added for softening) of bio-solids in each toilet pit.
- The solids removed include sand (from runoff), woody debris (fire related), chemical (toilet site cleaning), and pollutants (cans, bottles and other solids).
- Some of the hazards associated with handling burnt debris at toilet sites include; asbestos dry can create a dust, PPEs were used.

**Recommendations:**

- Removal of the abandoned conventional water treatment plant (Barley Flats).
- Toilets damaged by the fire to be closed under health service guidelines (6 to 10 sites).

**Spills (20 gallons or more of fuel/oil spills):**

- Fuel tanker delivery transfers – Bracket Airport FS Helibase Type 1 Helicopters
- Electrical transformers containing PCB's – polychlorinated biphenyl
- FS water tender diesel spill on BAER rehab project
- Dozer oil spill during fire suppression (fire breaks)
- Oil drums found near Hansen Dam IC post

The Forest Service became responsible for cleanup and disposal of the entire sites (non-BAER funds were used in the cleanups). I requested funding of \$2500 (through FE and FMO staff) for implementing fire related activities for disposal.

**HazMat – Collection/Disposal:**

LEI assisted Forest Resource employees (fire crew) with a marijuana site clean-up operation (in Devil's Canyon). The cleanup included 50 lbs of trash, a small propane tank and cooking stove, 100-300 lbs of fertilizers, one gallon of pesticides and one pound of rat dry pesticides.

**Restoration includes:**

- Collection and disposal of pesticides and fertilizer
- Collection and disposal of trash and camping gear
- Removal of irrigation lines and supplies

**Threat and Risk to Resource Area**

The threat to human health and the unacceptable degradation to natural resources including water, soil and wildlife is a continued risk to the Forest Service.

**What happened during the winter of 2009/10?**

Events of winter, there were several high intensity rainstorm events, including several heavy windstorm events within the fire perimeter. The mulching treatments are showing evidence of deterioration and will not function as contracted or as expected for 18 months to 2 year periods.

**Why did it happen?**

Two watershed drainages within the burn above treatments with burned hill slopes contributed to the unanticipated movement of debris and sediment off the slopes and drainages and onto two treatment sites?

### **Recommendations for next winter (2010/2011)**

Due to the high risk of anticipated sediment loading at Monte Cristo and Angeles Crest Stations these facilities should be given a high priority for preparation before winter along with removal of the large propane tanks at these sites. Selected sites need re-hydromulching treatment before winter. Laboratory testing for amounts of hazardous materials at each site is needed. Develop an asbestos management plan.

### **What did you learn from the burned area survey?**

Lesson learned of the Hydromulch treatments were installed before the winter season but they will not last or function as expected for 18 months to 2 years. State and County road closures prevented Forest Service and contractors from accessing additional hydromulch treatments areas during the contracted scheduled.

### **What did you learn that will be useful?**

For the future having employees from the Angeles NF proved to be a high value for both the assessment and implementation of the BAER treatments. Their expertise included helping develop contracts coordinating work and serving as COR's over prescribed work.

### **GIS Considerations for Large Fires**

*Authors and Home Units: Mark Schug & Carly Gibson, Stanislaus National Forest*

(Please see page 18 for description of GIS considerations)