

BURNED AREA EMERGENCY RESPONSE PLAN REVIEW AND APPROVAL

I. Superintendent approval that the Burned Area Emergency Response Plan meets approved land management plan management objectives.

Billy Shott, Acting Superintendent, Southeast Arizona Group

Date

II. Regional Fire Management Officer concurrence that the plan fits the technical definition for use of Emergency Stabilization funding.

Michael Davin, Fire Management Officer, NPS Intermountain Region

Date

III. Emergency Stabilization Funding Approval (check one box below):

☐ Approved

☐ Approved with Revision (see attached)

☐ Disapproved

John Wessels, Regional Director, NPS Intermountain Region

Date

IV. Emergency Stabilization Funding Approval (check one box below):

☐ Approved

☐ Approved with Revision (see attached)

☐ Disapproved

Rich Schwab, NPS BAER Coordinator

Date

Monument Fire

BURNED AREA EMERGENCY RESPONSE PLAN



UNIT: Coronado National Memorial

LOCATION: Hereford, Cochise County, Arizona

DATE: July 12, 2011

PREPARED BY: Ad Hoc BAER Team

Submitted By: Signature on file Date: 07/21/2011
Michele Girard, Burned Area Emergency Response Team Leader

EXECUTIVE SUMMARY

Introduction

The memorial was established as a unit of the national park system to commemorate and interpret Francisco Vásquez de Coronado's 16th-century expedition into what is now the United States. The memorial's southern boundary is on the border between the United States and Mexico. It offers extraordinary views of the San Pedro River Valley, and the National Park Service has an opportunity to interpret for visitors the first major exploration by Europeans into the American Southwest.

This Burned Area Emergency Response Plan has been prepared in accordance with Department of the Interior and National Park Service policy. This plan provides emergency stabilization recommendations for all NPS lands burned within the memorial Fire perimeter and downstream impact areas, which includes 100% of Coronado National Memorial. The primary objectives of the Monument Fire Burned Area Emergency Response Plan are:

- To prescribe cost effective post-fire stabilization measures necessary to protect human life, property, and critical cultural and natural resources.
- To promptly stabilize and prevent further degradation to affected resources on lands within the fire perimeter or downstream impact areas and mitigate damages caused by fire suppression operations in accordance with approved land management plans and policies, and all relevant federal, state, and local laws and regulations.
- Restore, to the extent possible, normal park operations and visitor opportunities to experience the park's natural and cultural resources.
- Perpetuate and/or restore native desert grasslands, including habitat components important for endangered species.

This plan addresses emergency stabilization and non-emergency burned area rehabilitation treatments. The assessments were completed and treatments recommended by an ad hoc BAER team under the direction of Michele Girard (SOAR) over the course of about two weeks, overlapping in some cases with suppression activities and READ responsibilities to the suppression incident. This plan was assembled from multiple sources by Sandee Dingman (LAKE) during the period of July 5-13. Girard and Bianca Torres (CORO) worked on watershed with Girard directing the work of numerous fire personnel staged in the park during the last half of the incident; Jeremy Curtis (SEAZ) with help from numerous people worked on facilities; Dingman, Dana Backer (SAGU), and Hubbard (SODN) with others worked on vegetation; Girard worked on wildlife; as of July 12 the cultural resources assessment and treatment recommendations had not been completed. Susan Studd and Dan Stauning (SODN) provided GIS support for this report.

Individual resource Burned Area Assessment Reports produced by these specialists are in Appendix I. The individual emergency stabilization treatments and activities including effectiveness monitoring identified in the assessments can be found in Part F. The individual burned area rehabilitation treatment

and activities including effectiveness monitoring identified in the assessments can be found in Part G. Appendix II contains the National Environmental Policy Act (NEPA) compliance documentation summary. Appendix III contains the Burned Area Emergency Response Plan maps. Appendix IV contains supporting documentation.

Fire Background

The Monument Fire was reported at 1 pm on June 12, 2011 burning in Coronado National Memorial (CORO). Air support was requested immediately but the fire spread quickly due to extreme fire conditions: high winds, low humidity, high temperatures, and low fuel moisture. The fire quickly spread to national forest and private lands. CORO and Coronado National Forest (CNF) share jurisdiction. The fire is within the Huachuca Mountains and associated valley bottoms south of Sierra Vista in southern Arizona. Much of CORO burned in the first operational period and the remainder burned over the next three days. There was relatively little direct suppression on the NPS lands. The fire was declared contained on July 7, 2011 at 30,526 acres.

Michele Girard, Ecologist with the NPS Southern Arizona Group, served as the onsite Resource Advisor during suppression and then transitioned to BAER Leader. She served as the primary liaison to the Forest Service BAER Team whose assessment occurred concurrently with this one. The initial NPS BAER request was submitted on June 21 and updated June 27 with Linda Kerr, Intermountain Regional BAER Coordinator. Work focused on emergency stabilization including culvert clearing and removing floatable debris from the channel that might interfere with the functioning of the drainage system on Montezuma Pass Road. Work was performed primarily by fire personnel staged in CORO during the incident. Also during this time period, park maintenance and facilities staff conducted preliminary damage assessments of park infrastructure. Sandee Dingman was assigned as a READ on July 5 to finalize the BAER plan, including a non-emergency burned area rehab. Katie Johnson (ZION) arrived on July 10 to assume a 30 day detail as the BAER Implementation Leader for both CORO and CHIR.

Fire Damages and Threats to Human Safety and Critical Natural and Cultural Resources

Of most concern is the threat to Montezuma Canyon Road, a historic CCC road with 76 historic culverts and extensive rock work. The concern is for post-fire floods and/or debris flows to overrun the existing drainage system resulting in entrapment of vehicles between flood or debris damaged road segments on the side of a steep mountain side. Such events also pose a direct threat to the road itself, both as an important part of the parks infrastructure, major point of access for the Department of Homeland Security, and as a historic resource.

Also of major concern is the loss of agave as a primary food source for the endangered lesser long-nosed bat which occupies a late summer roost in State of Texas Mine that is an important colony for species recovery. The agave throughout the park and beyond was burned over in the fire, killing many smaller plants and delaying flowering for those that survived. As most of the parks agave existed in the edge of the grasslands, the concern is that exotic lovegrasses increased fire intensity which resulted in higher than normal agave mortality and the situation has the potential to get worse by the fact that lovegrasses typically respond very favorably to fire.

All of the park's major infrastructure survived the fire, though some isolated facilities were lost. Of most concern was the loss of the parks repeater. Also the park lost wayfinding signs, interpretive signs, and

benches.

Coronado National Memorial Management Requirements

The park management organization for Coronado is somewhat unusual in the NPS. It is one of three NPS units managed as the Southeast Arizona Group (SEAZ), mostly sharing the same division chiefs for all three parks. The other two units of SEAZ are Chiricahua National Memorial (which incidentally also burned in a separate fire at about the same time as CORO) and Fort Bowie National Historic Site, both located about 2 hour drive away in the Chiricahua Mountains to the east. These parks, as well as many other small units are also served administratively and for resource management expertise by the Southern Arizona Office (SOAR) in Phoenix. The park is also part of the Sonoran Desert Inventory & Monitoring (SODN I&M) Program. For fire management and to some extent for other aspects of park operations, these parks are also supported by Saguaro National Park (SAGU) located in Tucson.

Also of note is that the SEAZ was without a Chief of Resources Management at the time of the fire, the position having been vacated in September 2010 and the new chief selected but not expected to arrive in the park until late July. To address that concern, Michele Girard (SOAR) was filling in that role while still doing her regular job. Concurrently with the fire incident, the Park Superintendent was in the process of moving to a new park leaving the area in late June. An acting superintendent, Billy Shott, was detailed in from Intermountain Regional Office for the month of July.

As of the completion of this document, the park's small staff has been subjected to extraordinary stresses, including an emergency evacuation during initial attack, sustained evacuation and stress during the fire incident, and the daunting task of adjusting to a park that was entirely burned over. In addition, the post-fire watershed effects have already started to be realized with the onset of the summer monsoon and the park has already been evacuated one time due to debris flows and flash flooding on the park road with the threat of new evacuations and emergency response every day as the clouds build.

The General Management Plan (GMP, 2004) and Fire Management Plan (FMP, 2005) are the most relevant documents to guide decisions needed regarding BAER. Pertinent sections are excerpted below:

- The GMP identifies the following statement as contributing to the parks significance: "The memorial, near the center of the Sky Island bioregion (the juncture of four major biogeographic provinces: Madrean, Sonoran, Chihuahuan, and Southern Rockies/Mogollon), preserves a rich biological and geological diversity. Visitors are able to enjoy recreational opportunities that foster a better understanding and appreciation of the area's natural and human history."
- The GMP states that the "fire management programs in the memorial will be designed to meet resource management objectives prescribed for various areas of the memorial and to ensure that firefighter and public safety are not compromised." All fire management activities will take place in accordance with the GMP.
- The FMP is an action plan under the approved Natural and Cultural Resources Management Plan (RMP) (NPS 1998) for carrying out the memorial's fire management program. The objectives pertinent to fire listed in the RMP include:

- Conduct an active fire management program in the memorial.
 - Implement a system of efficient record-keeping.
 - Maintain and develop the staff's fire suppression and prescribed fire skills through training opportunities.
 - Keep a current interagency Memorandum of Understanding (MOU) in order to fulfill NPS obligations.
 - Evaluate fire effects for Madroan oak and grassland species and communities.
- The FMP described two Fire Management Units:
 - Fire Management Unit 1: Lehmann Lovegrass unit (550 acres). FMU 1 is located in the southeastern corner of the memorial and is predominantly vegetated with the invasive species Lehmann lovegrass (*Eragrostis lehmanniana*). In addition to manual and/or mechanical treatments in this area, the use of prescribed fire will be allowed as a tool to reduce fuels and thereby reduce the risk to structures, employees, and visitors in Coronado National Memorial as well as a potential research tool to study fire effects in the Lehmann lovegrass. Using fire as a research tool may be done in conjunction with other tools such as seasonal effects of fire (timing), herbicide and reseeding. Any use of fire will necessitate a project level NEPA document. Potentially, fire might be used to help maintain or restore native plant species. Because of its location at the mouth of the watershed and the high fire incidence in the area, fuel treatments in FMU1 will be extremely important, and prescribed fire is one of the most cost-effective hazard reduction treatments.
 - Fire Management Unit 2: Oak Woodlands (5,250 acres). FMU 2 comprises the majority of the memorial, except the southeastern corner, which is in FMU 1. FMU 2 is primarily oak woodlands with small open oak savannahs and native grasslands in the northeastern portion. In addition to fire suppression, prescribed fire and mechanical fuel treatments may be used in this unit in the future after additional planning. Prescribed fire may be used to reduce hazardous fuel accumulations and prevent high-intensity, widespread wildland fire. This FMU contains the developed areas of the memorial headquarters, picnic area, and Montezuma Pass. After additional planning, mechanical thinning and prescribed fire may be used around those areas to reduce the potential for loss of structures. Suppression responses in FMU 2 may be limited by safety concerns such as steep slopes and lack of safety zones and escape routes.
- The FMP provides the following rehabilitation guidelines:
 - When a suppression action is taken, rehabilitation may be necessary. The most effective rehabilitation measure is prevention of impacts through careful planning and the use of MIST. The Incident Commander will initiate immediate rehabilitation actions, as soon as the risk of fire escape or threat has passed. Suppression rehabilitation will be directed toward minimizing or eliminating the effects of the suppression effort and reducing hazards (such as snags) caused by the fire immediately adjacent to developed areas. Sites impacted by fire suppression activities will be rehabilitated as necessary, based on approved standards developed by the park and given to the incident commander. If a small fire occurs, best practices through currently available science will be utilized to

guide suppression rehabilitation. If trails are used as fire breaks and fire suppression impacts occurred on those trails, some trail rehabilitation may be done. Short term fire suppression rehabilitation activities are a normal function of fire suppression and taken care of by incident resources and suppression fire accounts.

- Long-term rehabilitation, or fire impact recovery, activities depend on the severity of the fire. The general rehabilitation procedure after small fires is to let things come back naturally. For example, no reseeding will be done after a small fire. The exception to this guideline is the rehabilitation in FMU 1. This area may be reseeded if current science shows that reseeding with native grasses will decrease the population of exotic grasses. Any recovery efforts, reseeding, long term rehabilitation, or other non-suppression impact rehabilitation can only be done after a Burned Area Emergency Rehabilitation plan is developed. This plan must be submitted to the regional BAER coordinator (the Regional fire ecologist) for funding approval, based on the current national requirements.

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PART A - FIRE LOCATION AND BACKGROUND INFORMATION

Fire Name	Monument Fire
Fire Number	F4WS
Agency Unit	NPS Coronado National Forest
Region	Intermountain Region
State	Arizona
County(s)	Cochise
Ignition Date/Cause	June 12, 2011, cause under investigation
Date Fully Contained	July 7, 2011
Jurisdiction	Acres
NPS: Coronado National Memorial	4750
USFS: Coronado National Forest	15675
DOD: Fort Huachuca	1212
Bureau of Land Management	198
State	480
Private	8211
Mexico	(not included in total) 1527
Total Acres	30,526

PART B - NATURE OF PLAN

Type of Action (check one box below)

☐	Initial Submission
☒	Amendment to the Initial Submission

PART C - OBJECTIVES

Emergency Stabilization Objectives

Mitigate post-fire flooding hazards and possible entrapment of people on Montezuma Canyon Road caused by floatable woody debris and/or inadequate road drainage.

Survey for and mitigate fire effects, post-fire watershed effects, and BAER treatment impacts on federally listed endangered species, including the lesser long-nosed bat (endangered), Mexican spotted owl (threatened), and yellow-billed cuckoo (candidate). Consult/confer with the US Fish and Wildlife Service as needed for the protection of these species.

Prevent the establishment of non-native invasive plants, including new species and new populations of previously existing species. Provide for containment of non-native lovegrasses in desert grasslands to prevent spread into the burned area.

Protect cultural resources from subsequent post-fire erosion and/or illegal collection, including the parks historic CCC road and trail system and numerous known archeological sites.

Provide for public safety in a post-fire landscape with safety signs and visitor messages.

Prepare and implement a flood hazard warning system, evacuation plan, and post-flood response strategy for park personnel, cooperators, and park visitors.

Burned Area Rehabilitation Objectives

Re-establish native plant communities unlikely to recover naturally from the fire.

Control non-native invasive plant species that may colonize burned areas, particularly lovegrass.

Re-establish important elements of wildlife habitat for the benefit of species of management concern, including the agave as the major food source the lesser long-nosed bat. Consult/confer with the US Fish and Wildlife Service as needed for the protection of lesser long-nosed bat, Mexican spotted owl, and yellow-billed cuckoo and their critical habitats that might exist in or near the burned area.

Replace or repair minor infrastructure damaged by fire.

PART D - TEAM ORGANIZATION

Burned Area Emergency Response Team Members:

Position	Team Member (Agency)
Team Leader	Michele Girard (SOAR)
Public Information	Denise Shultz (SEAZ), Sandee Dingman (LAKE)
Operations	Michele Girard (SOAR)
NEPA Compliance & Planning	Sandee Dingman (LAKE)
Hydrologist	Michele Girard (SOAR), Bianca Torres (CORO), with Tom Runyon (FS-BAER)
Soil Scientist	Dave Marr (FS-BAER)
Facilities	Jeremy Curtis (SEAZ)
Cultural Resources/Archeologist	Duane Hubbard (SOAR)
Vegetation Specialist	Sandee Dingman (LAKE), Dana Backer (SAGU)
Wildlife Biologist	Michele Girard (SOAR)
GIS Specialist	Sarah Studd (SODN), Dan Stauning (SODN)
Documentation/Computer Specialist	Sandee Dingman (LAKE)
Incoming BAER Implementation leader	Katie Johnson (ZION)

Resource Advisors: (Note: Resource Advisors are individuals who assisted the burned area emergency response team with the preparation of the plan. See Part H for a full list of agencies and individuals who were consulted or otherwise contributed to the development of the plan.

Name	Affiliation
Billy Shott	Acting Superintendent (CORO)
Nancy Willcox	Administrative Officer (CORO)

Matt Stoffolano	Chief Ranger (CORO)
Carlos Herrera	Maintenance Foreman (CORO)
Dean Schlichting	Biologist (CORO)
Perry Grissom	Fire Ecologist (SAGU)
Danielle Foster	Former Chief of Resources Management (CORO)
Andy Hubbard	Network Coordinator (SODN)
James Leckie	Lead Fire Effects Monitor (SAGU)

PART E - SUMMARY OF ACTIVITIES AND COSTS

The summary of activities and cost table below identifies emergency stabilization costs charged or proposed for funding from emergency stabilization (E13) and burned area rehabilitation (B11) funding sources.

LINE ITEM NUMBER	SPECIFICATION NUMBER	TITLE	UNIT	UNIT COST	NUMBER OF UNITS	WORK AGENT	COSTS
1	ES1	BAER Implementation Leader	acres	\$15	19416	F	\$287,830
2	ES2	Refine watershed assessment	acres	\$1	9708	F	\$31,254
3	ES3	Install Flood Warning System	acres	\$14,006	19416	C	\$48,000
4	ES4	Storm Patrol	NA	NA	NA	F	\$1,296
5	ES5	Hazard Tree Removal	Trail length (miles)	\$ 782	25.5	F	\$19,950
6	ES6	Remove floatable debris from channels	miles	\$ 956	56	F	\$53,540
7	ES7	Road clearing and culvert cleanout	culverts	\$ 214	304	F	\$65,034
8	ES8	BAER Plan Preparation	0	NA	0	0	\$ -
9	ES9	Repair critical park infrastructure burned in fire to restore safe operating conditions	miles	\$17,152	5	F	\$85,760
10	ES10	Public Safety Information Dissemination	signs	\$ 3,345	13	F/S	\$43,485
11	BAR1	Early Detection and Eradication of Invasive Plants	acres	\$ 7	14562	F	\$100,836
12	BAR2	Grassland/Agave Restoration	acres	\$ 68	4000	F/S	\$272,972
13	BAR3	Replace/Repair Minor Infrastructure	F	\$ 506	8.5	F	\$ 4,300
TOTAL COSTS							\$1,014,257

Work Agent: **C**=Coop Agreement, **F**=Force Account, **G**=Grantee, **P**=Permittees, **S**=Service Contract, **T**=Timber Sales Purchaser, **V**=Volunteer

PART F – TREATMENTS AND ACTIVITIES FOR EMERGENCY STABILIZATION

ES1: BAER Implementation Leader

TREATMENT/ACTIVITY NAME	BAER Implementation Leader	PART E SPECIFICATION #	ES1
NFPORS TREATMENT CATEGORY*		FISCAL YEAR(S) (list each year):	FY11, 12, 13, 14
NFPORS TREATMENT TYPE *		WUI? Y / N	Y
IMPACTED COMMUNITIES AT RISK		IMPACTED T&E SPECIES	

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

Number and Describe Each Task:
A. General Description: The BAER Implementation Leadership would include a 3 year term BAER implementation leader to oversee the administration, contracting, scheduling and other work necessary to implement all of the approved treatments and activities for both emergency stabilization and burned area rehabilitation. This person would complete required accomplishment reports, revise/prepare funding requests, status treatments and activities in NFPORS, and generally track E13 and B11 accounts. In addition, an in-house Coronado employee is needed in FY11 to itemize the E13 account for budget closeout and to account for costs incurred per treatment/activity during the transition from fire suppression to emergency stabilization. Communication to maintain a safe environment while in the field implementing treatments requires additional park radios. B. Location/(Suitable Sites): Duty station at CORO C. Design/Construction Specifications: The BAER Implementation Leader should be hired or laterally re-assigned as soon as possible as much of the prescribed work is of an emergency nature. Ideally this person should be hired under a biological science job series (e.g. 401) at the GS-9 or GS-11 level with full performance at a GS-11. The BAER Implementation Leader would report to the Chief of Resources Management. During the remainder of FY11, if the position cannot be promptly filled short-term detailees may be used to keep the work on track while the hiring process is underway. The park's Administrative Officer will manage the budget closeout utilizing overtime to reconcile the various accounts (E11, E13, B11) prior to end of the fiscal year close-out for FY11. Three handheld radios will be purchased to ensure safe field work. D. Purpose of Treatment Specifications: Leadership is needed to assure prompt and accurate implementation of prescribed emergency stabilization and burned area rehabilitation treatments and activities. At the time of the fire, this park had a resource management staff of one term biologist funded by and dedicated to work related to the Department of Homeland Security border fence. A new Chief of Resources Management has been selected but has not arrived and will have a full workload of non-BAER related work when he does arrive. BAER Implementation leadership is needed as there is no organizational capacity to absorb the projected workload without these additional positions. E. Treatment Effectiveness Monitoring Proposed: N/A

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
GS-401-11/3 Term or detailee w/40% benefits @ \$3286/pp x 6 pp for FY11	\$19,716
GS-401-11/3 @ \$3286/pp x 26 pp for FY12	\$85,436
GS-401-11/3 @ \$3286/pp x 26 pp for FY13	\$85,436
GS-401-11/3 @ \$3286/pp x 14 pp for FY14	\$46,100
GS-9/10 Overtime 40 hours @ \$44.40/hour (w/ 22% Bene) FY 11	\$1,822
TOTAL PERSONNEL SERVICE COST	\$238,510
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	COST / ITEM
GSA vehicle @ \$500/month x 2 months for FY11	\$1,000

GSA vehicle @ \$500/month x 12 months for FY12	\$6,000
GSA vehicle @ \$500/month x 12 months for FY13	\$6,000
GSA vehicle @ \$500/month x 7 months for FY14	\$3,500
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$16,500
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM
Trimble GPS	\$ 2,000
Digital camera	\$ 500
Laptop	\$ 2,000
Annual IT computer assessment FY 11,12,13,14	\$ 2,000
External hard drive	\$ 200
Handheld radios 3 @ \$2000/ea	\$ 6,000
TOTAL MATERIALS AND SUPPLY COST	\$ 12,700
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
Travel cost for detailee(s) @ \$127/day lodging + M&IE x 60 days for FY11	\$7,620
Various trips to Tucson and CORO for coordination 10 trips/year x \$500/trip for FY12	\$5,000
Various trips to Tucson and CORO for coordination 10 trips/year x \$500/trip for FY13	\$5,000
Various trips to Tucson and CORO for coordination 5 trips/year x \$500/trip for FY14	\$2,500
TOTAL TRAVEL COST	\$20,120
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL CONTRACT COST	\$ -

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YY)	PLANNED COMPLETION DATE (M/D/YY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
FY 11	07/13/11	09/30/11	F	acres	\$ 9	4854	\$41,358
FY 12	10/01/11	09/30/12	F	acres	\$20	4854	\$96,936
FY 13	10/01/12	09/30/13	F	acres	\$ 20	4854	\$96,936
FY 14	10/01/13	07/06/14	F	acres	\$11	4854	\$52,600
TOTAL					\$ 15	19416	\$287,830

Work Agent: **C**=Coop Agreement, **F**=Force Account, **G**=Grantee, **P**=Permittees, **S**=Service Contract, **T**=Timber Sales Purchaser, **V**=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	X
5. No cost estimate required - cost charged to Fire Suppression Account.	

P = Personnel Services, **E** = Equipment **M** = Materials/Supplies, **T** = Travel, **C** = Contract, **F** = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT

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TOTAL COST BY JURISDICTION

JURISDICTION					UNITS TREATED	COST

						TOTAL COST	\$ -

ES 2: WATERSHED

TREATMENT/ACTIVITY NAME	Refine watershed assessment	PART E SPECIFICATION #	ES2
NFPORS TREATMENT CATEGORY*		FISCAL YEAR(S) (list each year):	FY11
NFPORS TREATMENT TYPE *		WUI? Y / N	Y
IMPACTED COMMUNITIES AT RISK		IMPACTED T&E SPECIES	

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

Number and Describe Each Task:
A. General Description: Pre-existing vegetation plots will be used to assess change in soil and vegetation conditions in order to refine the soil burn severity and vegetation mortality maps. The refinements will include adjustments of the BARC map to reflect field observations. The refined soil burn severity map and vegetation mortality map will then be used to re-run watershed response models to determine potential threats to park values at risk as a result of post-fire watershed response. Also, there are 18 long-term monitoring plots burned during the Monument fire, and all were read prior to the fire. These plots are part of the long-term monitoring design for SODN, but are not scheduled to be re-read for another 5 years. Collecting this post-fire data will provide important baseline data for park restoration and management efforts. B. Location/(Suitable Sites): Conduct rapid assessments of vegetation and substrate severity on 120 existing long-term monitoring plots throughout the park. Reread 18 burned long-term monitoring plots 1 year post-fire (FY2012-2013 growing season); SODN will read an additional 6 plots as part of the existing monitoring scheme. C. Design/Construction Specifications: Assess vegetation and soil severity per FMH and BAER protocols; estimate potential erosion due to fire. D. Purpose of Treatment Specifications: Assess initial fire severity and erosion potential, which will affect life and property in downhill areas, including campground and Visitor Center. E. Treatment Effectiveness Monitoring Proposed: Results will guide post-fire stabilization and infrastructure rehab associated with erosion.

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hour X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
2 Term Biotechs (2 GS-5/1 @ \$20.625/hour x 80 hours x 1FY); hourly cost assumes 37.5% benefit rate; fieldwork & data input	\$ 3,301
Science Writer/Editor (GS-9/5@\$33.89/hour x 40 hours x 1 FY); editing and reporting *No Charge*	
Data Manager (GS-11-1@ \$37.83/hour x 40 hours x 2FY); hourly costs includes 37.5% benefit rate; GIS and data management *No Charge*	
Term Biotech Crew lead (1 GS-7/2 @ \$27.24/hour x 240 hours x 1FY); hourly cost assumes 37.5% benefit rate; fieldwork & data input	\$ 6,538
Term biotech (1 GS-5/1 @ \$20.63/hour x 240 hours x 1FY); hourly cost assumes 37.5% benefit rate; fieldwork & data input	\$ 4,951
Vegetation Ecologist (GS-11/4 @ \$41.61/hour x 80 hours x 1FY); hourly cost assumes 37.5% benefit rate; analysis and reporting *No Charge*	
Data Manager (GS-11-1@ \$37.83/hour x 40 hours x 2FY); hourly costs includes 37.5% benefit rate; GIS and data management *No Charge*	
TOTAL PERSONNEL SERVICE COST	\$ 14,790
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	COST / ITEM
RECON GPS/GIS handheld mapping systems (4) provided by SODN *No Charge*	
Tapes, guides, cameras, and other field equipment provided by SODN *No Charge*	
Vehicle use (300 miles/tour x 1 tours x \$0.50/mi) *No Charge*	

TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ -
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL MATERIALS AND SUPPLY COST	\$ -
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
2 GS-5 (2 @ \$20/day x 24 days x 1 FY); backcountry per diem based on 3 - 8day tours	\$960
2 GS-5 (2 @ \$20/day x 24 days x 1 FY); backcountry per diem based on 3 - 8day tours	\$960
TOTAL TRAVEL COST	\$ -
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
2 SCA interns (2 interns @ \$909/week x 2 weeks x 1FY); fieldwork and data input; includes housing and travel	\$3,636
2 SCA interns (2 interns @ \$909/week x 6 weeks x 1FY); fieldwork and data input; includes housing and travel	\$10,908
TOTAL CONTRACT COST	\$ 14,544

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YY)	PLANNED COMPLETION DATE (M/D/YY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
FY 12	10/01/11	07/06/12	F	plots	\$226	138	\$ 31,254
TOTAL					\$226	138	\$ 31,254

Work Agent: **C**=Coop Agreement, **F**=Force Account, **G**=Grantee, **P**=Permittees, **S**=Service Contract, **T**=Timber Sales Purchaser, **V**=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	X
5. No cost estimate required - cost charged to Fire Suppression Account.	

P = Personnel Services, **E** = Equipment **M** = Materials/Supplies, **T** = Travel, **C** = Contract, **F** = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT

ES 3: WARNING SYSTEM

TREATMENT/ACTIVITY NAME	Install Flood Warning System	PART E SPECIFICATION #	ES3
NFPORS TREATMENT CATEGORY*		FISCAL YEAR(S) (list each year):	FY11, 12, 13, 14
NFPORS TREATMENT TYPE *		WUI? Y / N	Y
IMPACTED COMMUNITIES AT RISK		IMPACTED T&E SPECIES	

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

Number and Describe Each Task:

- A. General Description: A USGS/NOAA flood warning stage will be installed in the Monument upstream of the park headquarters, living quarters, maintenance facilities, and Visitor Center to monitor both realtime precipitation and stream flow that will trigger an evacuation alert system.
- B. Location/(Suitable Sites): Montezuma Creek drainage above the Visitor Center/Admin area, exact placement to be determined in consultation with USGS
- C. Design/Construction Specifications: The system is available from the U.S. Geological Survey office in Tucson, AZ and will be acquired under an interagency agreement to install and maintain the system for three years. The system includes three stage sensors to measure streamflow and a rain gauge to measure precipitation. The rainfall, stage, and streamflow data will be available on the USGS public web page, linked to the park webpage. The WaterALERT system will be used to send real time data to a pre-designated duty officer at the park via phone or computer when a threshold is exceeded by a storm or flow event. The Duty Officer will then be responsible for manually operating the park's siren (which is already in place) and to coordinate visitor and employee evacuations according to the park's flood evacuation plan. The data will also be sent real time to the National Weather Service to be used to issue flood warnings.
- D. Purpose of Treatment Specifications: The purpose of this treatment is to protect human life from the dangers of flash floods and post-fire debris flows in desert canyons. All major drainages in the park were burned in the fire and virtually all park infrastructure and most visitor facilities are located in flood plains that are fed by intermittent streams in steep burned canyons with a long history of flash flooding and debris flows. This system will provide an early warning alert to evacuate flood prone areas when triggers for rainfall and/or streamflow are reached.
- E. Treatment Effectiveness Monitoring Proposed: The effectiveness of the early warning system and the evacuation procedures will be reviewed after each event using an after action review process. In addition, the USGS will monitor the system remotely and periodically inspect and test the system to assure that it is properly working.

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
TOTAL PERSONNEL SERVICE COST	\$ -
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	COST / ITEM
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ -
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM

TOTAL MATERIALS AND SUPPLY COST	\$ -
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL TRAVEL COST	\$ -
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
\$27,000 equipment, install, and maintenance agreement in FY11	\$ 27,000
\$7,000/year for maintenance and operation in FY12, FY13, and FY14	\$ 21,000
TOTAL CONTRACT COST	\$ 48,000

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YY)	PLANNED COMPLETION DATE (M/D/YY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
FY 11	07/11/11	07/29/11	C	1	\$ 6	4854	\$ 27,000
FY 12	10/01/11	09/30/12	C	1	\$7,000	4854	\$ 7,000
FY 13	10/01/12	09/30/13	C	1	\$7,000	4854	\$ 7,000
FY 14	10/01/13	06/25/14	C	1	\$7,000	4854	\$ 7,000
TOTAL					\$14,006	19416	\$ 48,000

Work Agent: **C**=Coop Agreement, **F**=Force Account, **G**=Grantee, **P**=Permittees, **S**=Service Contract, **T**=Timber Sales Purchaser, **V**=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	X
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	
5. No cost estimate required - cost charged to Fire Suppression Account.	

P = Personnel Services, **E** = Equipment **M** = Materials/Supplies, **T** = Travel, **C** = Contract, **F** = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT

Appendix IV Supporting Documentation includes a diagram and description of the rain and stream gage proposed for use with this treatment as well as a relevant scientific citation (Smith et al 2010).
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ES 4: STORM PATROL

TREATMENT/ACTIVITY NAME	Storm Patrol	PART E SPECIFICATION #	ES4
NFPORS TREATMENT CATEGORY*		FISCAL YEAR(S) (list each year):	FY11, 12
NFPORS TREATMENT TYPE *		WUI? Y / N	Y
IMPACTED COMMUNITIES AT RISK		IMPACTED T&E SPECIES	

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

Number and Describe Each Task:

A. General Description: This activity is to patrol the park prior, during, and immediately after storm events to assure public and employee safety, monitor weather and road conditions, serve as duty officer for the park's flood evacuation plan, and assess threats to life and property after storm events.

B. Location/(Suitable Sites): Throughout the park, primarily focusing on park roads and visitor facilities.

C. Design/Construction Specifications: This activity is estimated as a two-hour overtime call out for two law enforcement rangers. In reality the scale and duration of the response will vary based on the magnitude of the predicted or realized storm event. The call out will be coordinated through the park's regular dispatch system under the direction of the Park Superintendent and/or Chief Ranger.

D. Purpose of Treatment Specifications: This activity supports the parks post-fire flood evacuation plan and provides for the safe and timely evacuation and/or rescue of park visitors, employees, and cooperators.

E. Treatment Effectiveness Monitoring Proposed:
NA

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
GS-9/3 @ \$53/ hour callout OT x 2 hours x 3 events in FY11	\$ 318
GS-9/3 @ \$53/ hour callout OT x 2 hours x 3 events in FY12	\$ 318
GS 11/3 @ \$55/hour callout OT x 2 events in FY 11	\$ 330
GS 11/3 @ \$55/hour callout OT x 2 events in FY 12	\$ 330
TOTAL PERSONNEL SERVICE COST	\$ 1,296
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	COST / ITEM
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ -
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL MATERIALS AND SUPPLY COST	\$ -
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL TRAVEL COST	\$ -

CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL CONTRACT COST	\$ -

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YY)	PLANNED COMPLETION DATE (M/D/YY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
FY 11	07/13/11	09/30/11	F	NA	NA	1	\$ 648
FY 12	10/01/11	06/25/11	F	NA	NA	1	\$ 648
TOTAL					NA	NA	\$ 1,296

Work Agent: **C**=Coop Agreement, **F**=Force Account, **G**=Grantee, **P**=Permittees, **S**=Service Contract, **T**=Timber Sales Purchaser, **V**=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.		
2. Documented cost figures from similar project work obtained from local agency sources.		
3. Estimate supported by cost guides from independent sources or other federal agencies.		
4. Estimates based upon government wage rates and material cost.		X
5. No cost estimate required - cost charged to Fire Suppression Account.		

P = Personnel Services, **E** = Equipment **M** = Materials/Supplies, **T** = Travel, **C** = Contract, **F** = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT

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ES 5: HAZARD TREE REMOVAL

TREATMENT/ACTIVITY NAME	Hazard Tree Removal	PART E SPECIFICATION #	ES5
NFPORS TREATMENT CATEGORY*		FISCAL YEAR(S) (list each year):	FY11, 12, 13, 14
NFPORS TREATMENT TYPE *		WUI? Y / N	Y
IMPACTED COMMUNITIES AT RISK		IMPACTED T&E SPECIES	

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

Number and Describe Each Task:
A. General Description: This treatment assesses and safely removes fire or post-fire flood damaged trees that pose a hazard to roads, trails, buildings, or visitor use facilities (campgrounds, etc). B. Locations: Entire length of East Montezuma Canyon Road (4.9 miles), Cave Trail (0.75 mile), Joe's Canyon Trail (3.1 miles), Yaqui Ridge Trail (1.0 mile), Coronado Peak Trail (0.4 mile), Crest Trail (8.2 miles). C. Design/Construction Specifications: Trees will be assessed using the NPS Hazard Tree rating system and identified for removal. Some immediate work along the park road has been accomplished using fire personnel assigned to the Monument for fire severity details in late June/early July. Additional work is needed along the trails, which was not accomplished previously due to the lack of reliable radio communications as result of the repeater that was burned in the fire. After reliable communications are established and pending border activity that may make entry unsafe, all remaining areas will be assessed and treated. It is anticipated that the assessment and initial work would be completed by the end of July. In addition, some minimal amount of work will be needed in outyears to re-assess park facilities and fell additional trees that succumb to fire-induced or post-fire flood induced mortality. D. Purpose of Treatment Specifications: To protect park visitors, cooperators and employees as well as park infrastructure from the hazards of falling trees. E. Treatment Effectiveness Monitoring Proposed: The need for additional hazard tree removals will be assessed as part of storm patrols on park roads and by trail or facilities crew after major storm or wind events.

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
WL 7 Work Leader \$29/hour x 1 week FY 12	\$ 1,160
WL 7 Work Leader \$29/hour x 1 week FY 13	\$ 1,160
WL 7 Work Leader \$29/hour x 1 week FY 14	\$ 1,160
WG 5 Maintenance Worker 2 @ \$23/hour x 1 week FY 12	\$ 1,840
WG 5 Maintenance Worker 2 @ \$23/hour x 1 week FY 13	\$ 1,840
WG 5 Maintenance Worker 2 @ \$23/hour x 1 week FY 14	\$ 1,840
TOTAL PERSONNEL SERVICE COST	\$ 9,000
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	COST / ITEM
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ -
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL MATERIALS AND SUPPLY COST	\$ -
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years =	COST / ITEM

Cost/Item):	
NPS Housing @ \$70/week x 1 week x 3 crew members x 3 fiscal years (\$210/year)	\$ 630
Per Diem @ \$20/day x 4 days x 3 crewmembers x 3 fiscal years (\$240/year)	\$ 720
TOTAL TRAVEL COST	\$ 1,350
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
12 " wood chipper lease 2 week rental @ \$1600/week FY 12	\$ 3,200
12 " wood chipper lease 2 week rental @ \$1600/week FY 13	\$ 3,200
12 " wood chipper lease 2 week rental @ \$1600/week FY 14	\$ 3,200
TOTAL CONTRACT COST	\$ 9,600

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YY)	PLANNED COMPLETION DATE (M/D/YY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
FY 12	10/01/11	09/30/12	F	Trail length (miles)	\$782	8.5	\$ 6,650
FY 13	10/01/12	09/30/13	F	Trail length (miles)	\$782	8.5	\$ 6,650
FY 14	10/01/13	07/06/14	F	Trail length (miles)	\$782	8.5	\$ 6,650
TOTAL					\$782	25.5	\$ 19,950

Work Agent: **C**=Coop Agreement, **F**=Force Account, **G**=Grantee, **P**=Permittees, **S**=Service Contract, **T**=Timber Sales Purchaser, **V**=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	
5. No cost estimate required - cost charged to Fire Suppression Account.	

P = Personnel Services, **E** = Equipment **M** = Materials/Supplies, **T** = Travel, **C** = Contract, **F** = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT

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TOTAL COST BY JURISDICTION

JURISDICTION						UNITS TREATED	COST
						TOTAL COST	\$ -

ES 6: DEBRIS

TREATMENT/ACTIVITY NAME	Remove floatable debris from channels	PART E SPECIFICATION #	ES6
NFPORS TREATMENT CATEGORY*		FISCAL YEAR(S) (list each year):	FY11, 12, 13, 14
NFPORS TREATMENT TYPE *		WUI? Y / N	Y
IMPACTED COMMUNITIES AT RISK		IMPACTED T&E SPECIES	

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

Number and Describe Each Task:

- A. General Description: Floatable debris, such as trees, has the potential to mobilize downstream during storm events and clog culverts or create debris dams at natural pinch points. Either condition exacerbates the risks to human life and property and park infrastructure during post-fire storm events. This project focuses on the manual removal of woody debris upstream of culverts, road crossings, and natural pinch points within the stream channels of Montezuma Creek and its tributaries. Debris removal will need to be maintained for every storm and flooding event in order to protect values at risk downstream.
- B. Location/(Suitable Sites): Montezuma Creek and it's unnamed tributaries, approximately 14 miles total
- C. Design/Construction Specifications: Debris will be manually pulled from the channel and either scattered along upper terraces or piled by the road for chipping depending on location. Large woody materials will be bucked and stacked for haul off. Work in channels will not be performed when rain is probable due to personnel safety. Much of this work was accomplished in late June and early July by fire crews staged in the park for fire severity, however, some work remains and additional materials may be mobilized into the channels with future storm events. This work will need to be assessed and maintained throughout the funding cycle.
- D. Purpose of Treatment Specifications: Protect human life and park infrastructure, including the East Montezuma Canyon Road and it's many historic CCC culverts and rock walls.
- E. Treatment Effectiveness Monitoring Proposed: Channels will be assessed following storm events to determine the need for additional treatment.

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
WL 7 Work Leader \$29/hour x 1 week FY 11 (2 events)	\$ 2,330
WL 7 Work Leader \$29/hour x 1 week FY 12 (4 events)	\$ 6,640
WL 7 Work Leader \$29/hour x 1 week FY 13 (4 events)	\$ 6,640
WL 7 Work Leader \$29/hour x 1 week FY 14 (3 events)	\$ 3,480
WG 5 Maintenance Worker 2 @ \$23/hour x 1 week FY 11 (2 events)	\$ 3,680
WG 5 Maintenance Worker 2 @ \$23/hour x 1 week FY 12 (4 events)	\$ 7,360
WG 5 Maintenance Worker 2 @ \$23/hour x 1 week FY 13 (4 events)	\$ 7,360
WG 5 Maintenance Worker 2 @ \$23/hour x 1 week FY 14 (3 events)	\$ 5,520
TOTAL PERSONNEL SERVICE COST	\$ 43,010
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	COST / ITEM
GSA rental cost @ \$300/week x 2 weeks FY 11	\$ 600
GSA rental cost @ \$300/week x 4 weeks FY12	\$ 1,200
GSA rental cost @ \$300/week x 4 weeks FY13	\$ 1,200
GSA rental cost @ \$300/week x 3 weeks FY 14	\$ 900
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ 3,900
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM

TOTAL MATERIALS AND SUPPLY COST	\$ -
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
Housing and per diem 3 crewmembers (\$70/week, \$20/day, 10 days) FY 11	\$ 1,020
Housing and per diem 3 crewmembers (\$70/week, \$20/day, 20 days) FY 12	\$ 2,040
Housing and per diem 3 crewmembers (\$70/week, \$20/day, 20 days) FY 13	\$ 2,040
Housing and per diem 3 crewmembers (\$70/week, \$20/day, 15 days) FY 14	\$ 1,530
TOTAL TRAVEL COST	\$ 6,630
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL CONTRACT COST	\$ -

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YY)	PLANNED COMPLETION DATE (M/D/YY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
FY 11	07/13/11	09/30/11	F	miles	\$545	14	\$ 7,630
FY 12	10/01/11	09/30/12	F	miles	\$1,231	14	\$ 17,240
FY 13	10/01/12	09/30/13	F	miles	\$1,231	14	\$ 17,240
FY 14	10/01/13	06/26/14	F	miles	\$816	14	\$ 11,430
TOTAL					\$956	56	\$ 53,540

Work Agent: **C**=Coop Agreement, **F**=Force Account, **G**=Grantee, **P**=Permittees, **S**=Service Contract, **T**=Timber Sales Purchaser, **V**=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	
5. No cost estimate required - cost charged to Fire Suppression Account.	

P = Personnel Services, **E** = Equipment **M** = Materials/Supplies, **T** = Travel, **C** = Contract, **F** = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT

See Watershed Assessment in Appendix I.

ES 7: ROADS

TREATMENT/ACTIVITY NAME	Road clearing and culvert cleanout	PART E SPECIFICATION #	ES7
NFPORS TREATMENT CATEGORY*		FISCAL YEAR(S) (list each year):	FY11, FY12, FY13, FY14
NFPORS TREATMENT TYPE *		WUI? Y / N	Y
IMPACTED COMMUNITIES AT RISK		IMPACTED T&E SPECIES	

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

Number and Describe Each Task:

- A. General Description: Storm deposited debris will be removed from the surface of East Montezuma Canyon Road and the unpaved portion of the road will be re-graded as necessary to provide for safe travel over the Huachuca Mountains.
- B. Location/(Suitable Sites): East Montezuma Canyon Road (approx.. 9 miles), including approximately 76 historic CCC culverts and drainage structures.
- C. Design/Construction Specifications: Following each major storm event, the road will promptly be assessed by park personnel and the park maintenance crew will remove debris and grade the road as needed to restore the road to an operable condition. Each culvert will be inspected and cleaned as necessary to maintain its design capacity. Where warranted, a road engineer will be consulted in the event of road damage or unstable debris flows. In reality the scale and duration of the response will vary based on the magnitude and effects of the storm event. The number of storm events is estimated and will be adjusted accordingly.
- D. Purpose of Treatment Specifications: This treatment is needed to provide for safe travel over Montezuma Pass along the East Montezuma Canyon Road. This road is one of the only routes over the Huachuca Mountains and is heavily used by local residents, park visitors, and the Border Patrol as part of their homeland security responsibilities along the US-Mexico border.
- E. Treatment Effectiveness Monitoring Proposed: Road conditions will be assessed following storm events.

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
GS 9/10 Maintenance Worker \$30/hour (40% benefits) @ 40 hours x 3 events in FY 11	\$ 5,184
GS 9/10 Maintenance Worker \$30/hour @ 40 hours x 4 events in FY 12	\$ 6,912
GS 9/10 Maintenance Worker \$30/hour @ 40 hours x 4 events in FY 13	\$ 6,912
GS 9/10 Maintenance Worker \$30/hour @ 40 hours x 3 events in FY 14	\$ 5,184
WG 7 Maintenance Worker \$27/hour (40%benefits) @ 40 hours x 3 events in FY 11	\$ 4,666
WG 7 Maintenance Worker \$27/hour @ 40 hours x 4 events in FY 12	\$ 6,221
WG 7 Maintenance Worker \$27/hour @ 40 hours x 4 events in FY 13	\$ 6,221
WG 7 Maintenance Worker \$27/hour @ 40 hours x 3 events in FY 14	\$ 4,666
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ 45,966
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	COST / ITEM
4000 Gallon water tender 1 week @ \$810/week FY11	\$ 810
84" Steel roller 1 week @ \$1957/week FY11	\$ 1,957
Grader 1 week @ \$1500/week FY11	\$ 1,500
4000 Gallon water tender 1 week @ \$810/week FY12	\$ 810
84" Steel roller 1 week @ \$1957/week FY12	\$ 1,957
Grader 1 week @ \$1500/week FY12	\$ 1,500
4000 Gallon water tender 1 week @ \$810/week FY13	\$ 810
84" Steel roller 1 week @ \$1957/week FY13	\$ 1,957
Grader 1 week @ \$1500/week FY13	\$ 1,500
4000 Gallon water tender 1 week @ \$810/week FY14	\$ 810

84" Steel roller 1 week @ \$1957/day FY14	\$ 1,957
Grader 1 week @ \$1500/week FY14	\$ 1,500
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ 17,068
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM
Tools and equipment used to Clean Culverts, replacement tools, diesel for loader/ backhoe, safety equipment, etc. FY 11	\$ 500
Tools and equipment used to Clean Culverts, replacement tools, diesel for loader/ backhoe, safety equipment, etc. FY 12	\$ 500
Tools and equipment used to Clean Culverts, replacement tools, diesel for loader/ backhoe, safety equipment, etc. FY 13	\$ 500
Tools and equipment used to Clean Culverts, replacement tools, diesel for loader/ backhoe, safety equipment, etc. FY14	\$ 500
TOTAL MATERIALS AND SUPPLY COST	\$ 2,000
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL TRAVEL COST	\$ -
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL CONTRACT COST	\$ -

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YY)	PLANNED COMPLETION DATE (M/D/YY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
FY 11	07/12/11	09/30/11	F	culverts	\$192	76	\$ 14,617
FY 12	10/01/11	09/30/12	F	culverts	\$236	76	\$ 17,900
FY 13	10/01/12	09/30/13	F	culverts	\$236	76	\$ 17,900
FY 14	10/01/13	07/06/14	F	culverts	\$192	76	\$ 14,617
TOTAL					\$214	304	\$ 65,034

Work Agent: **C**=Coop Agreement, **F**=Force Account, **G**=Grantee, **P**=Permittees, **S**=Service Contract, **T**=Timber Sales Purchaser, **V**=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	X
5. No cost estimate required - cost charged to Fire Suppression Account.	

P = Personnel Services, **E** = Equipment **M** = Materials/Supplies, **T** = Travel, **C** = Contract, **F** = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT

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TOTAL COST BY JURISDICTION

JURISDICTION					UNITS	COST
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						TREATED	
						TOTAL COST	\$ -

ES 8: BAER PLAN

TREATMENT/ACTIVITY NAME	BAER Plan Preparation	PART E SPECIFICATION #	ES8
NFPORS TREATMENT CATEGORY*		FISCAL YEAR(S) (list each year):	FY 11
NFPORS TREATMENT TYPE *		WUI? Y / N	Y
IMPACTED COMMUNITIES AT RISK		IMPACTED T&E SPECIES	

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

Number and Describe Each Task:

- A. General Description: An ad hoc BAER Team under the direction of Michele Girard completed BAER assessments, consultations, and developed specifications for treatments and activities. These elements are all included in a BAER Plan, completed on July 12.
- B. Location/(Suitable Sites): throughout Coronado National Memorial
- C. Design/Construction Specifications: The initial BAER request was submitted by Girard on June 18th. Over the next three weeks, various personnel both from the Southeast Arizona Group (CHIR, CORO, and FOBO) as well as additional resources ordered from outside the immediate area assisted with the development of the BAER Plan. In addition, Girard and Torres maintained communication with the Forest Service BAER Team and collaborated on the watershed assessment for the entire fire including the Memorial. Facilities and trail assessments were completed under the direction of the local facility manager Jeremy Curtis using a combination of local and fire resources. Andy Hubbard, Sarah Studd, and Dan Stauning (SODN) worked on vegetation assessment and GIS support. Dana Backer (SAGU) served as technical advisor for the vegetation assessment and grassland restoration treatments. Sandee Dingman (LAKE) compiled the BAER Plans. As of July 12, the cultural assessment, consultations, and treatments have not been initiated.
- D. Purpose of Treatment Specifications: The BAER Plan was developed to meet the requirements of 620 DM 3 and NPS requirements.
- E. Treatment Effectiveness Monitoring Proposed:
NA

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
TOTAL PERSONNEL SERVICE COST	\$ -
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	COST / ITEM
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ -
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL MATERIALS AND SUPPLY COST	\$ -
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM

TOTAL TRAVEL COST	\$ -
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL CONTRACT COST	\$ -

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YY)	PLANNED COMPLETION DATE (M/D/YY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
FY <u> </u>					#DIV/0!		
TOTAL					NA	0	\$ -

Work Agent: **C**=Coop Agreement, **F**=Force Account, **G**=Grantee, **P**=Permittees, **S**=Service Contract, **T**=Timber Sales Purchaser, **V**=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.		
2. Documented cost figures from similar project work obtained from local agency sources.		
3. Estimate supported by cost guides from independent sources or other federal agencies.		
4. Estimates based upon government wage rates and material cost.		
5. No cost estimate required - cost charged to Fire Suppression Account.		

P = Personnel Services, **E** = Equipment **M** = Materials/Supplies, **T** = Travel, **C** = Contract, **F** = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT

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TOTAL COST BY JURISDICTION

JURISDICTION						UNITS TREATED	COST
						TOTAL COST	\$ -

ES 9: INFRASTRUCTURE

TREATMENT/ACTIVITY NAME	Repair critical park infrastructure burned in fire to restore safe operating conditions	PART E SPECIFICATION #	ES9
NFPORS TREATMENT CATEGORY*		FISCAL YEAR(S) (list each year):	FY11, 12
NFPORS TREATMENT TYPE *		WUI? Y / N	N
IMPACTED COMMUNITIES AT RISK		IMPACTED T&E SPECIES	

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

Number and Describe Each Task:

A. General Description: 1) The park's only radio repeater was burned in the fire and is being replaced to provide for critical communication for law enforcement, fire and safe park operations. 2) In addition, the entire trail system, a historic resource, was burned over and is now vulnerable to erosion that will likely exacerbate the effects of post-fire watershed events and create downstream problems if the trail is not repaired as soon as possible. Crest Trail needs berm reconstruction, water bars, armoring and checks on switchbacks, and erosion control work along majority of trail length. Yacqui Ridge Trail needs work on existing water bars, construction of additional water bars, berm work and tread construction due to increased debris and water flow down trail. 3) two remote cameras used for law enforcement purposes were consumed in the fire.

B. Location/(Suitable Sites):

C. Design/Construction Specifications:

D. Purpose of Treatment Specifications: 1) The repeater is needed to provide reliable communications in support of law enforcement activities, ongoing park operations, post-fire flood response, fire response, emergency stabilization and burned area rehab work. Cell coverage is limited in the park. The trail system, a historic resource associated with CCC, was entirely burned over and wood components were burned beyond use. 2) Of particular concern, is the Joe's Canyon Trail where numerous cut log steps up a steep slope were consumed by fire, creating a debris chute. The trail system needs to be reconstructed, with particular concern for restoring the historic alignment and elements, to avoid further damage to the historic resource and exacerbating the effects of post-fire watershed events. The Crest and Yacqui Ridge trails need water bar reconstruction and implementation, as well as various other treatments to repair existing erosion as well as deflect future debris flows. 3) The cameras to be replaced are HC600 HyperFire High Output Covet IR with Security Enclosure, available from Recnyx in Holmen, Wisconsin.

E. Treatment Effectiveness Monitoring Proposed: The treatment is successful when the repeater is fully functional and reliable.

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
WL 7 Work Leader @ \$29/hour x 20 hours (Yacqui Trail)	\$ 600
WG 5 Maintenance Worker @ \$23/hour x 20 hours (Yacqui Trail)	\$ 500
WL-07 Work Leader @ \$29/hr x 3PP (Crest Trail)	\$ 7,000
WG-07 Maintenance Worker @ \$27/hr x 3PP (Crest Trail)	\$ 12,960
WG-05 Maintenance workers @ 2 x \$23/hr x 2PP (Crest Trail)	\$ 6,750
WG-03 Laborers @ 2 x \$19/hr x 2PP (Crest Trail)	\$ 6,200
GS-07 Admin Support @ \$25/hr x 20 hours	\$ 500
TOTAL PERSONNEL SERVICE COST	\$ 34,510
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	COST / ITEM
Repeater (**Has an S number associated with this purchase**) \$24,000	
HC600 HyperFire cameras 2 @ \$550	\$ 1,100
HyperFire security enclosure 3 @ \$50	\$ 150

TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ 1,250
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM
Joe's Canyon trail cut log step project*	\$ 50,000
TOTAL MATERIALS AND SUPPLY COST	\$ 50,000
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL TRAVEL COST	\$ -
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL CONTRACT COST	\$ -

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YY)	PLANNED COMPLETION DATE (M/D/YY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
FY 11	07/06/11	09/30/11	F	NA	NA	NA	\$ 1,250
FY 12	10/01/11	09/30/12	F	miles	\$ 16,902	5	\$ 84,510
TOTAL					\$17,152	5	\$ 85,760

Work Agent: **C**=Coop Agreement, **F**=Force Account, **G**=Grantee, **P**=Permittees, **S**=Service Contract, **T**=Timber Sales Purchaser, **V**=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	
5. No cost estimate required - cost charged to Fire Suppression Account.	

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RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT

*Joe's Canyon step project cost estimate from previous work done in 2008. May or may not include labor
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TOTAL COST BY JURISDICTION

JURISDICTION					UNITS TREATED	COST
					TOTAL COST	\$ -

ES 10: PUBLIC SAFETY INFORMATION

TREATMENT/ACTIVITY NAME	Public Safety Information Dissemination	PART E SPECIFICATION #	ES10
NFPORS TREATMENT CATEGORY*		FISCAL YEAR(S) (list each year):	FY11, 12
NFPORS TREATMENT TYPE *		WUI? Y / N	N
IMPACTED COMMUNITIES AT RISK		IMPACTED T&E SPECIES	

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

Number and Describe Each Task:

- A. General Description: Due to the increase in safety concerns brought about by the fire, visitor and public safety information will need to be available at trailheads, visitor center, and the park's trip planning website to increase their awareness of potential dangers which now exist in this post-fire environment.
- B. Location/(Suitable Sites): Trailheads, Visitor Center.
- C. Design/Construction Specifications: Five interpretive panels damaged by fire will be replaced and the text will be modified as needed to interpret the post-fire landscape or features and will meet the NPS Graphics Identity Standards. These items need to be replaced, and interpretive panels need to be redesigned due to features changed due to fire. Current public information does not adequately convey safety messages relevant to a post-fire landscape. Public will need to be informed about hiking hazards such as unstable terrain, displaced wildlife, hazard trees, burned stump holes and root chambers, flash flooding and debris flow. Bulletin boards that will have opening and locking windows will be added to allow for safety information to be updated as conditions change.
- D. Purpose of Treatment Specifications: These items are needed to restore normal park operations and provide for a positive, safe visitor experience. The public and visitor experience has changed in CORO due to the fire that burned the entire park. New hazards exist that they need to be aware of, and conditions will change as the environment adapts. With the increased threat of debris flows and flash flooding, among other potential hazards exacerbated by the fire, new signage must be in place.
- E. Treatment Effectiveness Monitoring Proposed: Completion of the repair or replacement work, including installation, will be considered successful.

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
Content design: GS9/5 2 PP @ \$30/hour	\$ 4,800
Compliance: GS 11/5 \$37/hour x 5 hours	\$ 185
Installation: WG 7 \$27/hour x 1PP	\$ 2,160
Installation: WG 5 \$23/hour x 1PP	\$ 1,840
TOTAL PERSONNEL SERVICE COST	\$ 8,985
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	COST / ITEM
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ -
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM
Wayside replacements 3 @ \$500/each	\$ 1,500
Bulletin boards 5 @ \$1000/each	\$ 5,000

Information signs 5 @ \$2000/each	\$ 10,000
Printing costs and supplies	\$ 500
Concrete and tools for installation	\$ 1,000
TOTAL MATERIALS AND SUPPLY COST	\$ 18,000
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
Travel	\$ 2,500
TOTAL TRAVEL COST	\$ 2,500
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
Layout and publication (signs)	\$ 14,000
Layout and publication (newspaper) - in kind contribution from WNPA \$2000	
TOTAL CONTRACT COST	\$ 14,000

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YY)	PLANNED COMPLETION DATE (M/D/YY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
FY 11	07/13/11	09/30/11	F/S	signs			\$ 7,485
FY 12	10/01/11	09/30/12	F/S	signs	\$2,769	13	\$ 36,000
TOTAL					\$3,345	13	\$ 43,485

Work Agent: **C**=Coop Agreement, **F**=Force Account, **G**=Grantee, **P**=Permittees, **S**=Service Contract, **T**=Timber Sales Purchaser, **V**=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.		
2. Documented cost figures from similar project work obtained from local agency sources.		
3. Estimate supported by cost guides from independent sources or other federal agencies.		
4. Estimates based upon government wage rates and material cost.		
5. No cost estimate required - cost charged to Fire Suppression Account.		

P = Personnel Services, **E** = Equipment **M** = Materials/Supplies, **T** = Travel, **C** = Contract, **F** = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT

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TOTAL COST BY JURISDICTION

JURISDICTION						UNITS TREATED	COST
						TOTAL COST	\$ -

PART G – TREATMENT AND ACTIVITIES FOR BURNED AREA REHABILITATION

BAR 1: WEEDS

TREATMENT/ACTIVITY NAME	Early Detection and Eradication of Invasive Plants	PART E SPECIFICATION #	BAR1
NFPORS TREATMENT CATEGORY*		FISCAL YEAR(S) (list each year):	FY12, 13, 14
NFPORS TREATMENT TYPE *		WUI? Y / N	Y
IMPACTED COMMUNITIES AT RISK		IMPACTED T&E SPECIES	

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

Number and Describe Each Task:
A. General Description: Weed vectors, including roads, trails, and fireline will be surveyed for early detection and eradication of insipient invasions of exotic plants. Treatments will depend on site conditions, environmental factors, and species biology, but may include chemical or manual control. B. Location/(Suitable Sites): Montezuma Canyon Road (4.3 miles), unpaved roads (4.9 miles), all park trails (7.6 miles), constructed handline (~ 0.5 miles) C. Design/Construction Specifications: The target for this treatment is new invasions, in particular herbaceous annual plants that are known be invasive in this environment. The Sonoran Desert I&M program (SODN) will survey the vectors once each in late fall (Dec), spring (Mar), and summer (Aug), following the typical precipitation seasons. Each survey area will be mapped using a modified version of Alien Plant Control and Management (APCAM) and recorded by GPS according to the I&M protocols (see supporting documentation). All detections will be relayed promptly to the Chief of Resources Management and the BAER Implementation Leader. Treatment will be undertaken promptly, ideally before seed production or dispersal. Eradication/treatment work will be performed by the park's BAER field crew if staffed, otherwise work will be coordinated with the Saguaro National Park's Restoration and Invasive Plant Management Program, an NPS Exotic Plant Management Program (to be determined), or alternative labor sources. D. Purpose of Treatment Specifications: Protect the park's native plant communities, wildlife habitat (including threatened and endangered species), and visitor experience from degradation caused by invasive plants. E. Treatment Effectiveness Monitoring Proposed: SODN

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
Treatment: Lead biotech GS-7 @ 1636/pp x 4 pp for FY12	\$ 6,600
Treatment: 3 crewmembers GS-5 @ 1320/pp x 3 pp for FY12	\$ 12,000
Treatment: Lead biotech GS-7 @ 1636/pp x 4 pp for FY13	\$ 6,600
Treatment: 3 crewmembers GS-5 @ 1320/pp x 3 pp for FY13	\$ 12,000
Treatment: Lead biotech GS-7 @ 1636/pp x 4 pp for FY14	\$ 6,600
Treatment: 3 crewmembers GS-5 @ 1320/pp x 3 pp for FY14	\$ 12,000
Early Detection: 2 GS 5/1 Term Biotechs (20.625/hour x 160 hours) FY 12	\$ 6,600
Early Detection: 1 GS 11/1 Veg Ecologist FY 12	\$ -
Early Detection: 1 GS 11/1 Data Manager FY 12	\$ -
Early Detection: 2 GS 5/1 Term Biotechs (20.625/hour x 160 hours) FY 13	\$ 6,600
Early Detection: 1 GS 11/4 Veg Ecologist FY 13	\$ -
Early Detection: 1 GS 11/1 Data Manager FY 13	\$ -
Early Detection: 2 GS 5/1 Term Biotechs (20.625/hour x 160 hours) FY 14	\$ 6,600
Early Detection: 1 GS 11/4 Veg Ecologist FY 14	\$ -
Early Detection: 1 GS 11/1 Data Manager FY 14	\$ -
TOTAL PERSONNEL SERVICE COST	\$ 75,600
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over	COST / ITEM

leasing or renting.	
RECON GPS/GIS handheld mapping systems (4) provided by SODN at no cost	\$ -
Tapes, guides, cameras, and other field equipment provided by SODN at no cost	\$ -
Vehicle provided by SODN at no cost	\$ -
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ 3,000
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM
herbicide for FY12	\$ 400
herbicide for FY13	\$ 400
herbicide for FY14	\$ 400
PPE @ \$100/year for FY12	\$ 100
PPE @ \$100/year for FY13	\$ 100
PPE @ \$100/year for FY14	\$ 100
plant presses and other supplies provided by SODN at no charge	\$ -
gasoline and other travel materials and supplies provided by SODN at no charge	\$ -
TOTAL MATERIALS AND SUPPLY COST	\$ 1,500
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
2 GS-5s (2 @\$20/day x 16days); backcountry per diem based on 8 day tours FY 12	\$ 640
2 GS-5s (2 @\$20/day x 16days); backcountry per diem based on 8 day tours FY 13	\$ 640
2 GS-5s (2 @\$20/day x 16days); backcountry per diem based on 8 day tours FY 14	\$ 640
TOTAL TRAVEL COST	\$ 1,920
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
2 SCA interns (2 interns @ \$909/week x 4 weeks); fieldwork and data input; includes housing FY 12	\$7,272
2 SCA interns (2 interns @ \$909/week x 4 weeks); fieldwork and data input; includes housing FY 13	\$ 7,272
2 SCA interns (2 interns @ \$909/week x 4 weeks); fieldwork and data input; includes housing FY 14	\$ 7,272
TOTAL CONTRACT COST	\$ 21,816

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YY)	PLANNED COMPLETION DATE (M/D/YY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
FY 12	10/01/11	09/30/12	F	acres	\$7	4854	\$ 33,612
FY 13	10/01/12	09/30/13	F	acres	\$7	4854	\$ 33,612
FY 14	10/01/13	07/06/14	F	acres	\$7	4854	\$ 33,612
TOTAL					\$7	14562	\$ 100,836

Work Agent: **C**=Coop Agreement, **F**=Force Account, **G**=Grantee, **P**=Permittees, **S**=Service Contract, **T**=Timber Sales Purchaser, **V**=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	X
5. No cost estimate required - cost charged to Fire Suppression Account.	

P = Personnel Services, **E** = Equipment **M** = Materials/Supplies, **T** = Travel, **C** = Contract, **F** = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT

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TOTAL COST BY JURISDICTION

JURISDICTION						UNITS TREATED	COST

BAR 2: AGAVE

TREATMENT/ACTIVITY NAME	Grassland/Agave Restoration	PART E SPECIFICATION #	BAR2
NFPORS TREATMENT CATEGORY*		FISCAL YEAR(S) (list each year):	FY 11, 12, FY13, FY14
NFPORS TREATMENT TYPE *		WUI? Y / N	N
IMPACTED COMMUNITIES AT RISK		IMPACTED T&E SPECIES	

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

Number and Describe Each Task:

- A. General Description: Approximately 100 acres of "fertile islands" of native grassland and 17 acres of agave will be established in the 1000 acre burned exotic grassland dominated by perennial, exotic lovegrasses. These islands will provide foraging habitat for the endangered lesser long-nosed bat and serve as a seed source for native granivores to aid in colonizing surrounding grasslands. The general techniques to be used include site selection and implementation plan preparation (FY11, not included in this request), herbicide treatment of exotic grasses (FY12-14), off-site agave propagation from existing local seed sources and outplanting (FY12-14), and native grassland seeding (FY14).
- B. Location/(Suitable Sites): The grassland area located south of Montezuma Canyon Road and east of the toe of the mountain, exact locations to be determined.
- C. Design/Construction Specifications: The fire presents an unexpected opportunity to restore areas of native grassland with agave in areas previously dominated by the non-native Lehmann's lovegrass and Boer's lovegrass, both of which increase fire intensity to the detriment of key native species such as the agave which is the only food source for the federally listed endangered lesser long-nosed bat. 1) The BAER implementation leader, in consultation with incoming chief of Resource Management and other local experts, will put together a more detailed restoration strategy and implementation plan. A key component will be identifying sites for the establishment of fertile islands based on several factors, including the results of the refined soil burn severity and vegetation mortality map (ES2) and the results of the cultural assessment (ES8). That plan will provide more detail regarding the proposed restoration strategy, but the major components are generally described here in items 2-4. 2) Glyphosate herbicide will be applied annually for three years during the active growing season, typically July-September but sometimes also in early spring depending on winter rain, to Lehmann's lovegrass and Boer's lovegrass using either backpack sprayers and/or ATV/UTV mounted spray equipment depending on site accessibility. 3) Agave will be propagated by the NRCS Tucson Plant Materials Center or local nursery using existing seed that was collected prior to the fire. Several thousand seeds are available, plus there are over 100 agave from park stock already rooted and available for outplanting from a prior project. Containerized agave seedlings will be outplanted in year 2 and/or year 3 depending on site conditions at each fertile island. Exact spacing and exact numbers will be determined after the sites are selected, but it is estimated that 7600 agave will be propagated and planted, allowing for about 20% mortality results in one plant per 100 square feet in a total of 17 acres. Dri-water will be applied to each seedling at the time of planting and refreshed as needed for up to one year if natural precipitation is insufficient. 4) A native grass and forb seed mix will be broadcast on the restoration areas in year 3 to provide competition for the lovegrasses and other invasive species. The exact species composition will be recommended in the implementation plan based on site characteristics and seed availability. The NRCS Las Lunas Plant Material Center will be contracted to maintain and harvest existing seed increase beds left over from a highway project at Carlsbad Caverns NP for these species: blue grama (*Bouteloua gracilis*), green sprangletop (*Leptochloa dubia*), plains bristlegrass (*Setaria vulpiseta*), sideoats grama (*Bouteloua curtipendula*), and purple three-awn (*Aristida purpurea*). Other local seed vendors and the availability of their seed sources, as well as the desired species composition for each site, will be explored during the development of the implementation plan. The labor source for this project would be the park's BAER field crew (1 lead biotech plus 2 biotechs/SCAs), augmented as needed by the Saguaro National Park's Restoration and Invasive Plant Management Program, youth work crews (such as the Southwest Conservation Corps), and/or an Exotic Plant Management Team.
- D. Purpose of Treatment Specifications: Re-establish agave, the food source for the federally listed lesser long-nosed bat, that were lost in the fire. As part of the agave restoration effort, the surrounding area will be restored to native grassland that is more resistant to high intensity fire and thus will help protect agave from loss in future fires. In addition, the restored native grassland will provide additional ecological benefits to the park's flora and fauna.
- E. Treatment Effectiveness Monitoring Proposed: SODN I&M

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
Lead Biotech (seasonal) GS-404-7/1 @\$1636/pp x 4 pp in FY12	\$ 6,544
Lead Biotech (seasonal) GS-404-7/1 @\$1636/pp x 4 pp in FY13	\$ 6,544
Lead Biotech (seasonal) GS-404-7/1 @\$1636/pp x 4 pp in FY14	\$ 6,544
2 biotech crewmembers (seasonal) GS-5/1 @ \$1320/pp x 4 pp in FY12	\$ 5,280
2 biotech crewmembers (seasonal) GS-5/1 @ \$1320/pp x 4 pp in FY13	\$ 5,280
2 biotech crewmembers (seasonal) GS-5/1 @ \$1320/pp x 4 pp in FY14	\$ 5,280
Youth work crew 10 person crew @ \$18000/80 hours for FY13	\$ 18,000
Youth work crew 10 person crew @ \$18000/80 hours for FY14	\$ 18,000
TOTAL PERSONNEL SERVICE COST	\$ 71,472
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	COST / ITEM
herbicide spray tank, wands, hose, nozzles, etc. @ \$2000 in FY11	\$2,000
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ 2,000
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM
Glyphosate herbicide 1000 acres @ \$1500/ac	\$ 15,000
Critter Out 5 gallons (covers 200,000 ft ²)	\$ 500
DriWater 3" tubes \$77.50/case (20 tubes/case) x 380 cases (7600 plants)	\$ 30,000
Freight for DriWater	\$ 2,000
TOTAL MATERIALS AND SUPPLY COST	\$ 47,500
TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL TRAVEL COST	\$ -
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
Agave propagation at Tucson Plant Material Center @ \$20/plant x 7600 plants	\$ 152,000
Grass seed at Los Lunas Plant Material Center @	
TOTAL CONTRACT COST	\$ 152,000

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YY)	PLANNED COMPLETION DATE (M/D/YY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
FY 11	07/12/11	09/30/11	F/S	acres	\$202	1000	\$ 201,500
FY 12	10/01/11	09/30/12	F	acres	\$12	1000	\$ 11,824
FY 13	10/01/12	09/30/13	F	acres	\$30	1000	\$ 29,824
FY 14	10/01/13	07/06/14	F	acres	\$30	1000	\$ 29,824
TOTAL					\$68	4000	\$ 272,972

Work Agent: **C**=Coop Agreement, **F**=Force Account, **G**=Grantee, **P**=Permittees, **S**=Service Contract, **T**=Timber Sales Purchaser, **V**=Volunteer

SOURCE OF COST ESTIMATE

1. Estimate obtained from 2-3 independent contractual sources.	
2. Documented cost figures from similar project work obtained from local agency sources.	
3. Estimate supported by cost guides from independent sources or other federal agencies.	
4. Estimates based upon government wage rates and material cost.	X
5. No cost estimate required - cost charged to Fire Suppression Account.	

P = Personnel Services, **E** = Equipment **M** = Materials/Supplies, **T** = Travel, **C** = Contract, **F** = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT

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TOTAL COST BY JURISDICTION

JURISDICTION	UNITS TREATED	COST
	TOTAL COST	\$ -

BAR 3: INFRATSTRUCTURE

TREATMENT/ACTIVITY NAME	Replace/Repair Minor Infrastructure	PART E SPECIFICATION #	BAR3
NFPORS TREATMENT CATEGORY*		FISCAL YEAR(S) (list each year):	FY12
NFPORS TREATMENT TYPE *		WUI? Y / N	N
IMPACTED COMMUNITIES AT RISK		IMPACTED T&E SPECIES	

* See NFPORS Restoration & Rehabilitation module - Edit Treatment screen for applicable entries.

WORK TO BE DONE (describe or attach exact specifications of work to be done):

Number and Describe Each Task:
A. General Description: Minor infrastructure in the park was burned by the Monument fire, miscellaneous wayfinding signs on park trails, 2 trail benches, one picnic table, and 3 interpretive panels. These items need to be replaced. B. Location/(Suitable Sites): multiple sites, see description below. C. Design/Construction Specifications: Five trail directional signs on Cave Trail and Joes Canyon Trail need to be replaced, though two other trails have not yet been assessed for damages due to border security issues so there may be more signs needed. The signs are the NPS brown and white wood routed signs on wooden posts and will be crafted in house. Three interpretive signs need to be replaced with new panels to meet the NPS Graphics Identity Standards, one of the three needs new panel design as the original text refers to features lost in the fire. The two benches are located along the Coronado Peak Trail and are constructed of wooden slats anchored to metal pipe set into rock structures. The slats need to be replaced by hand. D. Purpose of Treatment Specifications: These items are needed to restore normal park operations and provide for a positive visitor experience. E. Treatment Effectiveness Monitoring Proposed: Completion of the repair or replacement work, including installation, will be considered successful.

LABOR, MATERIALS AND OTHER COST:

PERSONNEL SERVICES: (Grade @ Cost/Hours X # Hours X # Fiscal Years = Cost/Item): Do not include contract personnel costs here (see contractor services below).	COST / ITEM
TOTAL PERSONNEL SERVICE COST	\$ -
EQUIPMENT PURCHASE, LEASE AND/OR RENT (Item @ Cost/Hour X # of Hours X #Fiscal Years = Cost/Item): Note: Purchases require written justification that demonstrates cost benefits over leasing or renting.	COST / ITEM
TOTAL EQUIPMENT PURCHASE, LEASE OR RENTAL COST	\$ -
MATERIALS AND SUPPLIES (Item @ Cost/Each X Quantity X #Fiscal Years = Cost/Item):	COST / ITEM
Directional signs 5 @ \$300/ea	\$ 1,500
Benches	\$ 1,500
Picnic table	\$ 1,300
TOTAL MATERIALS AND SUPPLY COST	\$ 4,300

TRAVEL COST (Personnel or Equipment @ Rate X Round Trips X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL TRAVEL COST	\$ -
CONTRACT COST (Labor or Equipment @ Cost/Hour X #Hours X #Fiscal Years = Cost/Item):	COST / ITEM
TOTAL CONTRACT COST	\$ -

SPECIFICATION COST SUMMARY

FISCAL YEAR	PLANNED INITIATION DATE (M/D/YY)	PLANNED COMPLETION DATE (M/D/YY)	WORK AGENT	UNITS	UNIT COST	PLANNED ACCOMPLISHMENTS	PLANNED COST
FY 12	10/01/11	09/30/12	F	miles	\$506	8.5	\$ 4,300
TOTAL					\$506	8.5	\$ 4,300

Work Agent: **C**=Coop Agreement, **F**=Force Account, **G**=Grantee, **P**=Permittees, **S**=Service Contract, **T**=Timber Sales Purchaser, **V**=Volunteer

SOURCE OF COST ESTIMATE

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P = Personnel Services, **E** = Equipment **M** = Materials/Supplies, **T** = Travel, **C** = Contract, **F** = Suppression

RELEVANT DETAILS, MAPS AND DOCUMENTATION INCLUDED IN THIS REPORT

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TOTAL COST BY JURISDICTION

JURISDICTION					UNITS TREATED	COST
					TOTAL COST	\$ -

PART H - CONSULTATIONS

U.S. Fish and Wildlife Service (Michele Girard - forthcoming)

Arizona State Historic Preservation Officer (Duane Hubbard - forthcoming)

APPENDIX I - BURNED AREA ASSESSMENT REPORTS

- Watershed Assessment
- Vegetation Assessment
- Wildlife Assessment
- Facility Assessment
- Cultural Assessment (To be completed)
- Public Safety Information Assessment

Monument Fire Watershed Assessment for Coronado National Memorial

Bianca Torres – Biological Technician
Michele Girard – Ecologist, NPS Southern Arizona Office

OBJECTIVES

- Identify where post-fire impacts such as flash flood and debris flows may be a hazard to human life, roads, historic structures, and critical natural and cultural resources.
- Assessing post-fire watershed response on Park Service developed sites such as the park's Visitors Center, campgrounds, picnic areas and administrative sites.
- Assess post-fire watershed impacts on long-term soil productivity and hydrologic function. This includes evaluating changes to soil conditions, hydrologic function, and watershed response to precipitation events.
- Develop treatment recommendations, if necessary
- Identify future monitoring needs, if necessary

ISSUES

- Risks to roads, buildings, and infrastructure due to potential of flash floods and debris/sediment flows from precipitation events.
- Risks to human life and property from post-fire impacts and precipitation events

OBSERVATIONS

Background Information

The purpose of a burned area assessment is to determine if the fire caused emergency watershed conditions and if there are potential values at risk from these conditions. Identification of values at risk occurs through consultation with individuals and among federal agencies, and confirmed through field investigation. If emergency watershed conditions are found, and values at risk are identified and confirmed, then the magnitude and scope of the emergency is mapped and described, values at risk and resources to be protected are analyzed, and treatment prescriptions are developed to protect values at risk. The most significant factor leading to emergency watershed conditions is loss of ground cover (vegetation), which leads to erosion and changes in hillslope hydrologic function in the form of decreased infiltration and increased runoff. Such conditions lead to increased flooding, sedimentation, deterioration of soil condition and/or debris flows. Values at risk are human life, property, roads, and critical natural and cultural resources located within or downstream of the fire that may be subject to damage from flooding, ash, and debris deposition, and hillslope erosion.

Oak woodland ecosystem hydrology is often based on generalizations and similarities drawn from similar or associated ecosystems. Increased erosion rates following fire are primarily due to loss of vegetation. Plant cover tends to reduce surface erosion by intercepting rainfall and reducing the impact of raindrops on the soil surface. Fire severity influences erosion due to changes in canopy cover, litter, soil organic matter and mineral soil.

The land mass is generally destabilized by a lack of anchoring roots and high soil pore water pressures. When hydrophobic soils are present they effect infiltration and overland flow. A water repellent will usually occur between two wettable layers. Post fire precipitation can infiltrate the upper wettable soil layer until it reaches the water-repellent layer at which further downward movement or lateral movement stops. Once top layers of soil become saturated, the soil has a potential to become unstable and resulting in sediment loss from the system. Following fire, increased runoff and erosion during precipitation events may trigger debris flows in steep drainages.

Hydrophobic soils do not appear to be extensive across the burned area as the soils are shallow and many lack organic matter. However, the Huachuca Mountains are subject to debris flows following heavy rain and fire (Wohl and Pearthree 1991). Coronado National Memorial (CORO) sustained 21 debris flows in 2006 following approximately 12 inches of rain in 24 hours. Montezuma Pass Road was blocked by debris at 15 locations where drainage structures (low water crossings and culverts) were blocked with debris. The threat of debris flows may be reduced at CORO following the Monument Fire because of the 2006 events. Wohl and Pearthree (1991) report that sufficient weathered material must accumulate in the upper channel reaches to initiate a large debris flow. If enough material is not present, the material introduced into the channel may only move a short distance. Ann Youberg (geomorphologist, Arizona Geological Survey - pers. comm.) feels the risk is less at CORO as the watershed has not had time to 'reload' sufficient material.

The most critical value at risk in CORO is the Montezuma Pass Road. The road is subject to frequent flooding. The road is the only east/west passage through the Huachuca Mountains and accesses US Forest Service lands, private property, and is an important interdiction route for US Border Patrol (BP). The administration buildings at CORO are on the hillslopes and have not been subject to flooding in the past.

An interagency Burned Area Emergency Rehab (BAER) team was assembled and included staff from the US Forest Service (USFS), National Park Service and Department of Defense. Due to the higher number of acres burned and the private homes at risk on USFS lands, reconnaissance on NPS lands was limited to allow team members to focus on USFS lands.

RECONNAISSANCE METHOD

Values at risk were determined from a Burned Area Reflectance Classification (BARC) satellite imagery map of the Monument Fire from the Remote Sensing Applications Center (RSAC) in Salt Lake City, Utah. The BARC map is a product derived from pre and post-fire satellite imagery of the burned area and provides an initial look at the burn severity within the fire area. Initial BARC imagery of the Monument Fire included Forest Service, Park Service, State, and private land. This data was collected for the Forest Service BAER Report and data was shared with Coronado National Memorial. However, staff of the Sonoran Desert Inventory and Monitoring Network (SODN) have expressed concerns about the accuracy of the BARC map based on recent experiences on other fires. SODN will continue to refine the BARC map with a focus on Coronado National Memorial and the watershed response models will be re-run. (See Recommendations: BARC Map).

Hydrology

The hydrologists on the BAER Team began the limited BAER watershed survey on Sunday, June 25th,

2011, by conducting an on-the-ground reconnaissance within the burn area and adjusted the preliminary map based on ground observation and assessments.

Soils

Information was gathered specifically for the Memorial by David Marr, a Resource Advisor for the Monument Fire. The criteria used to evaluate soil burn severity on the ground included assessments of duff layer consumption ash depth and color, and soil water repellency (hydrophobicity). The water drop infiltration test was used and assessments of various burn severity locations were tested on preliminary BARC maps. Initial calibration findings were used as a basis to visually examine the entire burned area within the park.

Infrastructure

Trail crews hiked all trails within the park and made initial assessments of impacted structures resulting from the Monument Fire. Some trails within the Memorial are listed as a historical resource.

Engineering

Field investigations of the forest system roads and the Montezuma Canyon Road within the Coronado National Monument were conducted from June 26th through June 28th, 2011 by Forest Service road engineers and monument staff. The purpose of the reconnaissance was to determine and assess potential impacts on the roads system due to the wildfire. After completing the field investigations, reconnaissance was made by reviewing post-fire burn intensity maps and severity maps, the hydrologists calculated flows at specific point of concern or “pour points”. GIS was used to obtain rough estimates of slope percentage for watersheds above the pour points.

FINDINGS

All the following findings and values at risk are based on current BARC map data from Forest Service BAER Team. Once a new BARC map is redefined, the hydrologic response models will be re-run.

Hydrology

The Wildcat5 (Richard H. Hawkins and Armando Barreto; BETA Test Release in cooperation with USDA Forest Service and STREAM Systems Technology Center) storm runoff model was used to predict peak flow runoff generated in key watersheds under pre- and post-burn conditions. This model utilizes runoff curve numbers and triangular unit hydrographs to route rainfall excess to the mouth of stream channels or critical identified pour points within a watershed. The model does not attempt to route runoff along channels. The hydrologist made estimates of pre- and post-burn Runoff Curve Numbers for each of the Hydrologic Soil Groups located within the modeled watershed. These estimates were based on the observations of the post burn survey, Landsat infrared remote sensing imagery (BARC-Burned Area Reflectance Classification), and methods of analysis from the Hydrology section of the NRCS National Engineering Handbook and other sources. Curve numbers were also derived from remote sensing. Runoff Curve Number used can be found in Table 1.

Table 1: Runoff Curve Numbers by Hydrologic Soil Group and Burn Severity

Soil Class	Burn Intensity	Runoff Curve Number
A	Unburned	36
	Low	48
	Moderate	65
	High	75
B	Unburned	57
	Low	65
	Moderate	74
	High	84
C	Unburned	69
	Low	73
	Moderate	82
	High	90
D	Unburned	78
	Low	80
	Moderate	88
	High	94

Table 2: Hydrologic Soil Classification Group for pour points in Coronado National Memorial: Montezuma Canyon

SOIL CLASSIFICATIONS BY WATERSHED					
Pour Point #	Hydrologic Soil Group (acres)				Total Acres
	A	B	C	D	
1	0.00	31.70 (73.72%)	10.30 (23.95%)	1.00 (2.32%)	43.00
2	0.00	18.4 (33.8%)	36.0 (66.2%)	0.00	54.40
3	3.00 (0.31%)	200.10 (20.4%)	324.9 (33.1%)	454.7 (46.3%)	982.70
4	0.00	0.00	29.00 (12.4%)	204.5 (87.6%)	233.50
5	0.00	48.20 (11.92%)	56.5 (13.98%)	299.5 (74.10%)	404.20
6	0.00	0.00	8.60 (23.07%)	28.60 (76.72%)	37.28

Group A soils have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sand or gravel and have a high rate of water transmission (greater than 0.30 in/hr).

Group B soils have moderate infiltration rates when thoroughly wetted and consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission (0.15- 0.30 in/hr).

Group C soils have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine texture. These soils have a low rate of water transmission (0.05-0.15 in/hr).

Group D soils have high runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very low rate of water transmission (0-0.05 in/hr).

The design storm (NOAA Atlas 14) selected to evaluate pre and post fire hydrology for watersheds within the park was for the 2-year, 5-year, and 10-year 30-minute storm. The total rainfall for the 2 year-30 minute storm ranges from 0.952-1.23 inches. Total rainfall for the 5-year 30 minute storm ranges from 1.23-1.59 inches. The 10-year 30 minute storm has a range of 1.43-1.85 inches. The average rainfall per storm event was modeled for each of the watersheds of the Monument.

When interpreting the reported values it should be kept in mind that, due to inherent margins of error in the analysis, the absolute estimates of peak flow are less important than the comparisons between watersheds and between pre- and post-burn conditions.

The analysis shows the increases in peak flow to be expected under conditions of a 2-year, 5-year, and 10-year 30-minute storm (NOAA Atlas 14). Also, as stated earlier, the Wildcat5 model does not perform channel routing of flood flows from one study watershed to the next.

Before an adjusted design flow can be determined for post-fire conditions, pre-fire design flow must be calculated. This is the flow expected to occur prior to the fire. This is the flow responsible for forming present day channel conditions and flows used to estimate proper performance of culverts and other drainage structures. Design flow estimates have been determined utilizing the Wildcat model. These estimates assume pre-fire ground infiltration and ground cover conditions. Tables 3, 4, and 5 display changes in flow for all pour points regarding pre-fire and post-fire storm events. Figure 1 shows all the pour points modeled with in the Memorial

Figure 1: Coronado National Memorial Pour Points

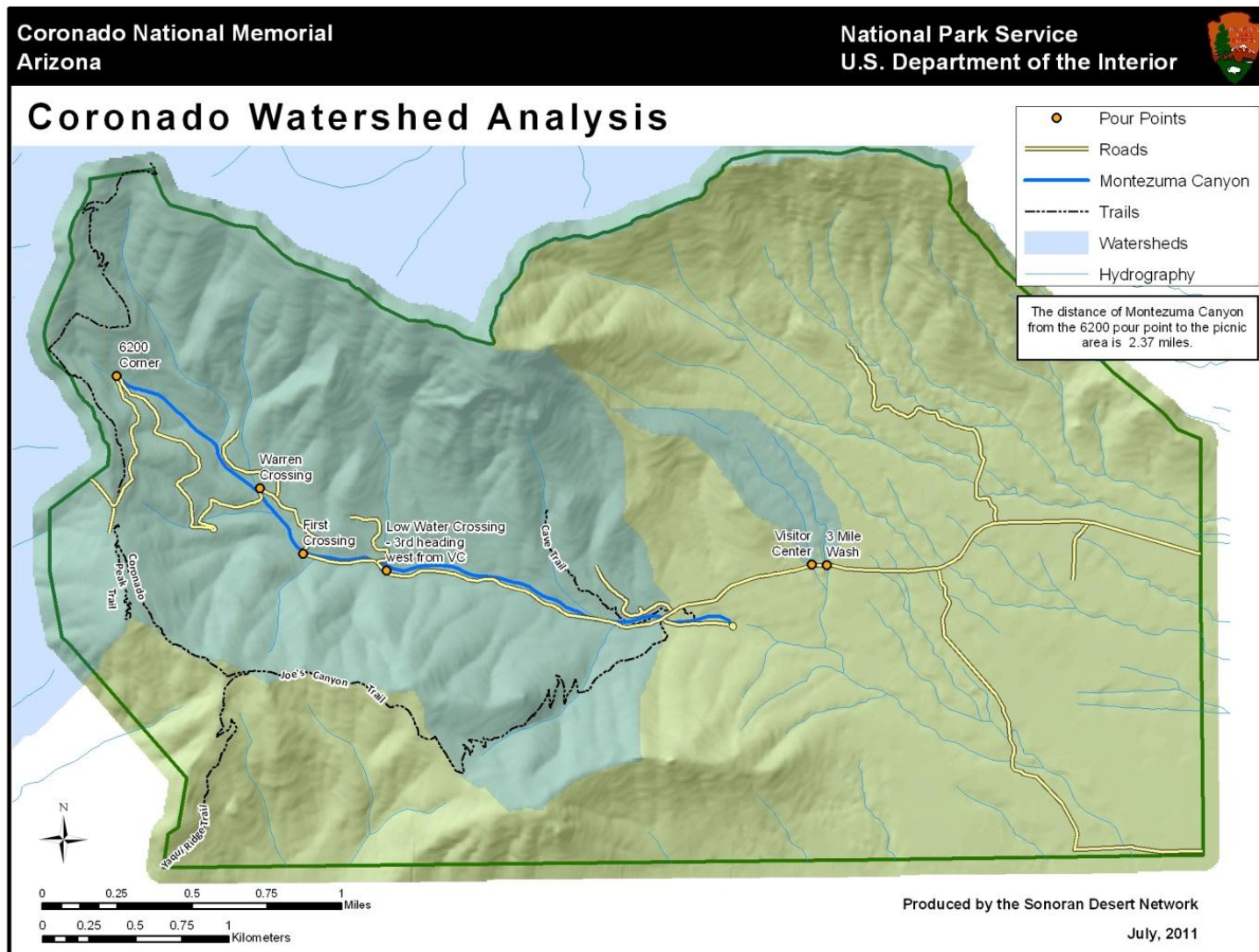


Table 3: Displays the change in flow for all pour points: pre fire and post fire for a 2-year 30 minute storm

Point Number	Approximate Location in Watershed	Total Acres	Pre-Fire CFS	Post-Fire CFS	% Increase
1	3 Mile Crossing (point A)	43.00	0.2	3.7	1750.00%
2	3 Mile Crossing (Point B)	54.40	0.4	9.2	2200.00%
3	3 rd Low Water Crossing	982.70	59.6	171.7	188.09%
4	First Crossing	233.50	63.9	159.7	149.92%
5	Warren Crossing	404.20	45.7	117.7	157.55%
6	6200 Crossing	37.28	7.8	11.9	52.56%

Table 4: Displays the change in flow for all pour points: pre fire and post fire for a 5-year 30 minute storm

Point Number	Approximate Location in Watershed	Total Acres	Pre-Fire CFS	Post-Fire CFS	% Increase
1	3 Mile Crossing (point A)	43.00	0.9	9.3	933.33%
2	3 Mile Crossing (Point B)	54.40	2.8	20	614.29%
3	3 rd Low Water Crossing	982.70	154.4	350.2	126.81%
4	First Crossing	233.50	154.8	312.2	101.68%
5	Warren Crossing	404.20	111.2	230.1	106.92%
6	6200 Crossing	37.28	18.4	26	41.30%

Table 5: Displays the change in flow for all pour points: pre fire and post fire for a 10-year 30 minute storm

Point Number	Approximate Location in Watershed	Total Acres	Pre-Fire CFS	Post-Fire CFS	% Increase
1	3 Mile Crossing (point A)	43.00	1.7	15	782.35%
2	3 Mile Crossing (Point B)	54.40	5.7	30.3	431.58%
3	3 rd Low Water Crossing	982.70	249.7	513.8	105.77%
4	First Crossing	233.50	244.8	448.73	83.30%
5	Warren Crossing	404.20	175.4	330.7	88.54%
6	6200 Crossing	37.28	29.1	39.7	36.43%

The Monument Fire is expected to respond to an average rainfall event, an event usually associated with the 1.25 year storm, differently for the low, moderate, and high severity burned areas. The unburned lands within the fire would respond as the unburned lands outside the fire. Increases in discharge associated with predicted recurrence intervals are prorated across watersheds by burn severity to yield post-fire discharge or the adjusted design flow.

After reviewing the results for each storm event, the recommended design storm is the 5-year 30 minute storm. Designing for a 5-year 30 minute storm is expected to be sufficient as it will also accommodate the 2-year storm event. The 10-year storm event has the lowest probability of occurring when compared to the 2 and 5 year.

Concerns and issues related to water quality within Coronado National Memorial have not been assessed as there are no perennial surface waters that serve as a source of domestic water or aquatic habitat for vertebrate species.

Soils

The Erosion Risk Management Tool (Robichaud et.al., 2006; Robichaud, 2007) was used to model both pre-fire and post-fire sediment response by each soil map unit. ERMiT was developed to model sheet and rill erosion in post-fire settings. All watersheds were evaluated for pre-fire hillslope sediment yields and expected increases using a 5 year runoff event. See Appendix B for modeling methods and assumptions.

Infrastructure

Park infrastructure was evaluated by the interagency BAER Team and park staff. There are a number of values at risk; the most critical are integrity of the Montezuma Pass Road and the trail system. A number of smaller park structures such as benches and signs were damaged or consumed by the fire. Some minor park property such as cameras and traffic counters were also damaged. Specific treatments for each of these resources are described below.

There are approximately 12 miles of trails. Many of the trails are in areas of inherent instability and some within the area of high burn severity.

TREATMENT RECOMMENDATIONS

Road Maintenance (ES)

A. General Description: The Montezuma Pass Road is the main system road that runs through the park. It is used to access destinations within the park such as Montezuma Pass and the visitor center. It is also used by private lands owners and the USFS to access lands on the west side of the Pass. The road is critical to the operations of the U.S. Border Patrol because it is the only east/west access across the Huachuca Mountains and because of its proximity to the international border between the United States and Mexico. The road contains a number of drainage structures built by the Civilian Conservation Corp (CCC) in the 1930's, and the entire road has been designated as a National Historic Landmark. The road is double lane for approximately 3 miles, is fully paved with striping down the center, the 3 miles consists of a crushed aggregate surface.

Drainage of the road has long been an issue as the geology of the watershed is dynamic and many of the historic culverts may be undersized. Henry Ruis, former Chief of Maintenance (pers. comm.), says that following the 1988 fire he had two people cleaning culverts for an entire year. Even in a non-burned, non-debris flow environment, the drainage of the road and the need to frequently clean the culverts has been an issue.

The road has been flooded twice in recent history. In 2006 approximately 12' of rain fell in 24 hours

(estimated as a 1000 year event) and caused flooding and debris flows throughout the memorial, and damage on the Montezuma Pass Road was severe. In 2008 a 50 year rainfall event in a portion of the watershed triggered flooding on the upper section of the paved portion of the road, again causing road damage.

B. Location: The Montezuma Pass Road bisects the memorial from east to west. It crosses the Montezuma Canyon drainage a number of times. Following is a description of specific drainage structures along the road that are at risk.

Three Mile Crossing. The area of greatest concern to the health and safety of visitors and staff are a set of two culverts, called Three Mile Crossing that is approximately 0.5 miles east of the Visitor Center. Visitors and staff must cross this area in order to leave the memorial. Because of even more severe problems along the road in the upper part of the watershed, leaving the memorial to the west is not an option. In the 2006 rainfall and debris flow event the culverts were insufficient to pass the water and debris. The culverts plugged and served to form a 'lake' that aggraded with sediment and debris. The channel is now 'over widened' and does not have a clear drainage pattern or the ability to carry sediment. The height of the aggraded sediment is actually higher than the road bed. Small rainfall events following the July 2006 debris flows resulted in water running over the road and park staff evacuated the park immediately or had to wait until the flows subsided. Since that time there have been no substantial rainfall events in that portion of the watershed. Issues at these culverts were discussed during negotiations to improve the paved section of the road with NPS and contracted road engineers and hydrologists between 2006 and when construction on the road was finally implemented in 2010. A number of alternatives were discussed and a preliminary design for a low water crossing was developed. The improvements were never implemented due to an apparent lack of funding.

The watershed above these two culverts was modeled as part of the BAER assessment. Although the two culverts are side-by-side in the drainage, the subwatersheds above the culverts were modeled separately by the team hydrologist. The results are shown in the previous tables for the two sites listed as '3 mile wash points A and B'. Results show a significant increase in runoff following the fire and concerns that these culverts will not function. Post-fire discussions with the engineers and hydrologists that worked on the original road improvement contract have raised the issues of the inability of the culverts to handle the predicted flows. They predict the culverts will plug up again and due to the amount of water and debris that will run-off, it could tear out this section of road – leaving visitors and staff stranded in the memorial.

Looking north on 3 Mile Wash



Looking south on 3 Mile Wash



Visitor Center Culverts. The paved section of the road is in the lower part of the watershed and thus must withstand the largest flows. These major features include two corrugated metal culverts installed next to each other and measuring 9-feet in diameter. The headwalls surrounding these culverts were built by the CCC. In 2006 these culverts became plugged with debris forming a dam. The water overtopped the road and scoured the channel on the downstream side of the culverts. Evidence of channel scouring and downcutting (3-4') is still evident. In 2008 the channel migrated and no longer flowed through the culverts. Part of the flow went over the road and part stayed in a new channel that drained directly toward the headwall (causing cutting and erosion around the historic wall) and then flowed over the road. In 2010 a road reconstruction project was completed that improved the road surface, installed three new low water crossings, and restored the channel to its original path. The channel was designed to Federal Highway standards and is capable of handling a 25 year rainfall event. It has not been determined if the new channel will withstand post-fire flows. It will depend on the timing and amount of precipitation.

We requested that these culverts be used as a pour point for the watershed modeling, but at this time the data is not available. The culverts are expected to function properly during the model storm event which is approximately 1.5" of rain in 30 minutes. A report, done in 2009 by Natural Channel Design, Inc., evaluated if the existing two 9-foot diameter culverts could pass the predicted 100-year event. It was concluded these culverts could pass the calculated flows but due to the restriction of the channel where the culverts are, the flows exiting the culvert would be highly erosive due to the increase in velocity.

Visitor Center Culverts



New Low Water Crossings. Three concrete hardened low water crossings with open grates were installed along the portion of the road between the Visitor Center and what is known as the First Crossing in 2010. These were installed as part of the road reconstruction in order to better drain the road following the 2006 debris flow event. These structures were designed to pass small flows through the grated box culvert, and larger storms would result in debris on the road that would need to be removed. There are also a number of culverts in this section of road. Data from Youberg (report dated 7/11/11) in the nearby Miller Canyon reports 1.66" of rain fell in approximately one hour, and that .72" of this event fell in 10 minutes triggering debris flows in that canyon. This event triggered flooding along this portion of the road. Debris was removed from the road surface at the 3 new crossings, and other areas. Several of the culverts were overwhelmed and completely plugged.

3rd Low Water Crossing looking south



Debris/sediment in grate of 3rd Low Water Crossing



3rd Low Water Crossing draining into Montezuma Wash





New low water crossing 2-3 hours
after storm 07/20/2011

First Crossing. The First Crossing is at the intersection of the paved and unpaved portions of the road. There was damage here in 2006 when the channel migrated to the upslope side of the channel and was cutting along the upper portion of the CCC headwall. A small reach of the drainage was rechanneled and the crossing has subsequently been working as designed.

First Crossing



First crossing after 07/20/2011 storm



Culverts. There are several culverts between the First and Warren Crossing. In 2006 these culverts plugged and the water drained down the inside of the road cutting a 'channel' approximately 2-3' deep and 2-3' wide. Following changes in drainage from the debris flows it appears that two of these culverts are either not in the right place, or that additional culverts need to be installed where the debris flows intersect the road. These culverts may not be large enough to handle the increase in flows. These culverts have CCC rock work as part of their design.

Warren Crossing. This crossing sustained heavy debris following the 2006 event. Debris was more the 10' deep on the road. The material was cleared, a new section of concrete apron was installed, and additional gabions were installed on the downstream side of the crossing. Since 2006 the crossing has functioned as designed, but there have not been any large precipitation events in this section of the watershed. The July 11, 2011, event appears to have been more concentrated in the lower areas of the watershed and

road. There is no evidence of recent flooding at this crossing or on the unpaved sections of the road.

Warren Crossing



Culverts. There are a number of culverts and associated CCC rock work on the road between the Warren and 6200 Crossings. These culverts were all overwhelmed with debris in 2006. On these culverts, the debris accumulated on the road and flowed over the road.

6200 Crossing. This crossing drains a small portion of the upper part of Montezuma Wash. Significant debris accumulated at this site in 2006. Since that time, the crossing has functioned as designed; however, there have not been any large precipitation events (as of yet) in this part of the watershed.



C. Design/Construction Specifications. Additional assessment of this critical resource is needed. Skills of the assessment team should include people with expertise in road engineering, and experience in debris flow environments with an understanding of the hydrology of burned areas in order to determine if the road is properly drained, make treatment recommendations, and to evaluate safety conditions along the road in the post-fire environment.

The road, culverts and low water crossing need to be continually inspected and maintained. Maintenance includes: cleaning the culverts, removing debris from the road surface and adjacent areas, and road grading as needed.

There may be a need for additional drainage structures or to upsize existing drainage structures,

following additional inspections by qualified experts.

D. Purpose of Treatment Specifications. These treatments would help ensure the safety of visitors, staff, and other agency personnel when traveling along the road. Treatments would also help reduce erosion and road surface damage.

E. Treatment Effectiveness Monitoring. Monitoring of road conditions will need to continue for the next three years, especially following rain fall events. Culverts will need to be continually inspected and cleaned.



Outlet View of the Nine Feet Diameter Culverts

Concrete Hardened Low Water Crossing with Slotted Grates

RECOMMENDATIONS

Refined Soil Burn Severity Map (ES)

It is recommended that a refined Soil Burn Severity map be developed for Coronado National Memorial. Pre-existing vegetation plots will be used to assess change in soil and vegetation conditions in order to refine the soil burn severity and vegetation mortality maps. The refinements will include adjustments to the BARC map to reflect field observations. The refined soil burn severity map and vegetation mortality map will then be used to re-run watershed response models to determine potential threats to park values at risk as a result of post-fire watershed response. Recommendations are not expected to change dramatically from a refined BARC map. Field work and analysis will be completed by the Sonoran Desert Network.

Install Flood Warning System (ES)

A. General Description: A USGS/NOAA flood warning stage will be installed in the Monument

upstream of the park headquarters, living quarters, maintenance facilities, and visitor center to monitor both real-time precipitation and stream flow that will trigger an evacuation alert system.

B. Location/(Suitable Sites): Montezuma Creek drainage above the Visitor Center/Admin area, exact placement to be determined in consultation with USGS

C. Design/Construction Specifications: The system is available from the U.S. Geological Survey office in Tucson, AZ and will be acquired under an interagency agreement to install and maintain the system for three years. The system includes three stage sensors to measure stream flow and a rain gage to measure precipitation. The rainfall, stage, and stream flow data will be available on the USGS public web page, linked to the park webpage. The WaterALERT system will be used to send real time data to a pre-designated duty officer at the park via phone or computer when a threshold is exceeded by a storm or flow event. The Duty Officer will then be responsible for manually operating the park's siren (which is already in place) and to coordinate visitor and employee evacuations according to the park's flood evacuation plan. The data will also be sent real time to the National Weather Service to be used to issue flood warnings.

D. Purpose of Treatment Specifications: The purpose of this treatment is to protect human life from the dangers of flash floods and post-fire debris flows in desert canyons. All major drainages in the park were burned in the fire and virtually all park infrastructure and most visitor facilities are located in flood plains that are fed by intermittent streams in steep burned canyons with a long history of flash flooding and debris flows. This system will provide an early warning alert to evacuate flood prone areas when triggers for rainfall and/or stream flow are reached.

E. Treatment Effectiveness Monitoring Proposed: The effectiveness of the early warning system and the evacuation procedures will be reviewed after each event using an after action review process. In addition, the USGS will monitor the system remotely and periodically inspect and test the system to assure that it is properly working.

G. The early warning system will be combined with Continuous Slope Area technology developed by USGS. These sensors monitor channel flow over time and help determine when the watershed has recovered from post-fire conditions and the most severe threats of flooding have passed.

Storm Patrolling (ES)

A. General Description: Park law enforcement staff will patrol the park prior, during, and immediately after storm events to assure public and employee safety, monitor weather and road conditions, serve as duty officer for the park's flood evacuation plan, and assess threats to life and property after storm events.

B. Location/(Suitable Sites): Staff will focus patrols on the Montezuma Pass Road, administrative sites, and the picnic area.

C. Design/Construction Specifications: This activity is estimated as a two-hour overtime call out for two law enforcement rangers. In reality the scale and duration of the response will vary based on the magnitude of the predicted or realized storm event. The call out will be coordinated through the park's regular dispatch system under the direction of the Park Superintendent and/or

Chief Ranger.

D. Purpose of Treatment Specifications: This activity supports the parks post-fire flood evacuation plan and provides for the safe and timely evacuation and/or rescue of park visitors, employees, and cooperators.

E. Treatment Effectiveness Monitoring Proposed: NA

Removal of Floatable Debris From Channel (ES)

A. General Description: Floatable debris, such as trees, has the potential to mobilize downstream during storm events and clog culverts or create debris dams at natural pinch points. Either condition exacerbates the risks to human life and property and park infrastructure during post-fire storm events. This project focuses on the manual removal of woody debris upstream of culverts, road crossings, and natural pinch points within the stream channels of Montezuma Creek and its tributaries.

B. Location/(Suitable Sites): Montezuma Creek and its unnamed tributaries, approximately 10-15 miles total.

C. Design/Construction Specifications: Debris will be manually pulled from the channel and either scattered along upper terraces or piled by the road for chipping depending on location. Large woody materials will be bucked and stacked for haul off, or will be cut up into 1-2' pieces that will easily flow downstream and not impair flow. Work in channels will not be performed when rain is probable due to personnel safety. Much of this work was accomplished in late June and early July by fire crews staged in the park for fire severity, however, some work remains and additional materials may be mobilized into the channels with future storm events.

D. Purpose of Treatment Specifications: Protect human life and park infrastructure, including the Montezuma Canyon Road, and the historic CCC culverts and rock walls.

E. Treatment Effectiveness Monitoring Proposed: Channels will be assessed following storm events to determine the need for additional treatment.

Road Clearing and Culvert Clean Out (ES)

A. General Description: Storm deposited debris will be removed from the surface of East Montezuma Canyon Road and the unpaved portion of the road will be re-graded as necessary to provide for safe travel over the Huachuca Mountains.

B. Location/(Suitable Sites): East Montezuma Canyon Road (approx 9 miles), including approximately 76 historic CCC culverts and drainage structures.

C. Design/Construction Specifications: Following each major storm event, the road will promptly be assessed by park personnel and the park maintenance crew will remove debris and grade the road as needed to restore the road to an operable condition. Each culvert will be

inspected and cleaned as necessary to maintain its design capacity. Where warranted, a road engineer will be consulted in the event of road damage or unstable debris flows. In reality the scale and duration of the response will vary based on the magnitude and effects of the storm event. The number of storm events is estimated and will be adjusted accordingly.

D. Purpose of Treatment Specifications: This treatment is needed to provide for safe travel over Montezuma Pass along the East Montezuma Canyon Road. This road is one of the only routes over the Huachuca Mountains and is heavily used by local residents, park visitors, and the Border Patrol as part of their homeland security responsibilities along the US-Mexico border.

E. Treatment Effectiveness Monitoring Proposed: Road conditions will be assessed following storm events.

Culvert of Low Water Crossing at 3-Mile Wash (ES)

A. General Description: Installation of a box culverts or a low water crossing similar to water crossings along Montezuma Canyon road

B. Location/(Suitable Sites): Three Mile Wash is a relatively smaller wash between the Park entrance and the Visitor's Center. A history of flash flooding (2006, 2008) has caused issues for park employees not being able to cross this section of road.

C. Design/Construction Specifications: Further consultation with NPS staff and other experts is needed.

D. Purpose of Treatment Specifications: A low water crossing or larger culverts would reduce the potential of inconvenience and danger for park staff and visitors not being able to cross the road to leave the park in cases of emergency.

E. Treatment Effectiveness Monitoring Proposed: Routine inspections and maintenance of the structures would need to be conducted to ensure they are functioning properly.

Repair Critical Park Infrastructure (ES)

A. General Description: All of the trails at CORO were burned over and are vulnerable to increased erosion that will likely exacerbate the effects of post-fire watershed events causing damage to the trails and creating downstream problems if the trails are not repaired as soon as possible.

B. Location/(Suitable Sites): There are approximately 12 miles of trails at CORO. Many of the trails are in areas of inherent instability and some within the area of high burn severity. Some trails are designated as historical resources. The following are findings from the initial assessment conducted by the Saguaro National Park Trail Crew:

- Joe's Canyon – This trail is approximately 3 miles in length and is a popular hike for visitors. This trail is classified as part of the National Trails System and classified as National Recreational Trails. The trail needs to be cleared of debris and hazard trees, and the drainage needs to be maintained. Work requires a class A or B faller and swamper. There are numerous wooden drainage structures and steps that burned and need to be replaced.

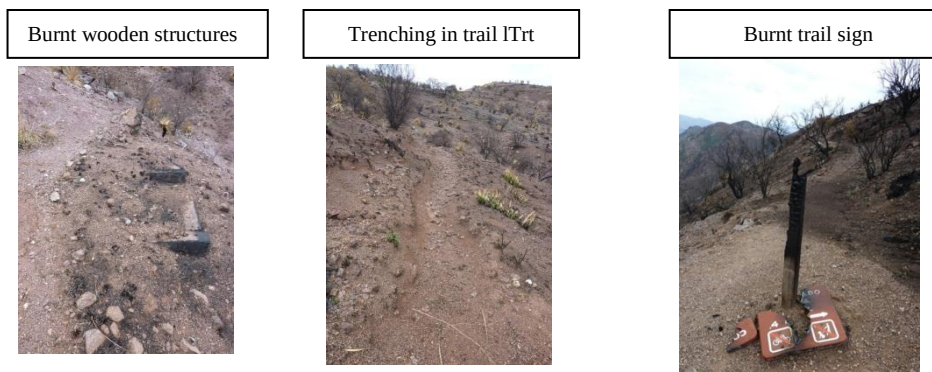
- Grassland Trail – This trail was recently constructed and is 1 ½ miles in length. Recommended treatments includes: brush out engine tracks, seed specific areas, improve drainage, and remove debris.
- Picnic Trail – This trail was assessed and no treatments were recommended.
- Cave Trail – The Cave Trail is 1 mile in length. The trail was assessed and no treatments were recommended.
- Crest Trail- This trail is 1 ½ miles in length and connects with the trail system on USFS lands. This trail along with Yacqui Ridge Trail are part of the Arizona Trail. The assessment found the first half mile showed signs of increased water flow and debris due to recent rain fall. De-berming and out sloping needed as well as improvements to existing water bars. Retaining wall needed to repair erosion concern at three locations. Berm and outslope need to be repaired on 85% of trail. There are two 50' crib walls on the trail, the first crib wall needs some erosion control and the trail leading up to the second crib wall needs an erosion control wall. The switchbacks on the trail need maintenance including armoring on the inside elbow and checks constructed between the switchbacks. On the last half mile berm and outslope needs are severe, and treatments include adding swales and the need for additional waterbars. Hazard trees were found throughout the trail (A class).
- Yacqui Ridge- Yacqui Ridge Trail is one mile from Joe's Canyon trail and in steep terrain. Yaqui is part of the Arizona Trail. 90% troughed out with increased water flow running down the trail. This trail sustained damage during recent rains including soil erosion and post-fire debris deposition. There is evidence of increased water running down the trail instead of draining off the tread. Treatments include berm and outsloping the tread along the entire trail, clean existing water bars and install additional waterbars. The trailhead was burned and needs to be replaced.

C. Design/Construction Specifications: Trails will be reconstructed to NPS standards (http://www.nps.gov/iatr/parkmgmt/trail_handbook.htm)

D. Purpose of Treatment Specifications:

Trails will be reconstructed and maintained to standards in order to protect this valuable infrastructure, prevent accelerated erosion, and reduce sediment deposition into drainages.

E. Treatment Effectiveness Monitoring Proposed: Trails will be monitored following rainfall events in order to immediately conduct maintenance needed to protect the trail and reduce erosion. Monitoring will need to be conducted for the next three years or until the watershed has stabilized.



CONSULTATIONS

Several consultations across agencies and parks were utilized. All initial assessments except trails were thanks to Forest Service BAER Team members. All trail assessments were conducted by Saguaro National Park, Pinnacles National Monument, and Chiricahua National Monument trail crew members.

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APPENDIX B- MODELING METHODS AND ASSUMPTIONS

- The ERMit (Emergency Risk Management Tool)¹ model was used to develop watershed sediment delivery rates using a modified Mt. Wilson, CA climate. RockClimo Rock
- Mountain Research Station Climate Generator² was used to modify the climate for the burn area.
- Textures assigned to ERMit were based on data retrieved from the Natural Resources Conservation Service's Soil Data Mart. On the ground sampling revealed that sandy loam was the dominant soil texture with a lesser extent of loam and silty clay loam.
- Slopes were derived from a slope analysis of Digital Elevation Models. An average slope for each map unit was used for ERMit modeling.
- Slopes were estimated using Digital Elevation Models and on-site verification.
- ERMit models sediment delivery rates based on "Probability that sediment yield will be exceeded". For this report, I chose to report the sediment yield at a value of 50 percent probability sediment yield will be exceeded. In other words, there is a 50 percent chance when looking at all the storm events for the area that the sediment yield reported will be exceeded. This can loosely be thought of as the average sediment yield during an average storm.

1 Erosion Risk Management Tool (ERMit) Ver. **2006.01.18**. [Online at <http://forest.moscowfsl.wsu.edu/fswepp/>.] Moscow, ID: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station

Monument Fire Vegetation Assessment for Coronado National Memorial

By Sandee Dingman, Botanist, Lake Mead NRA, Dana Backer, Saguaro National Park



I. Objectives

- Assess vegetation mortality and predict fire response of dominant species
- Assess fire effects on agave, a primary food source for the endangered long-nosed bat
- Prescribe vegetation treatments related to emergency stabilization
- Explore opportunities for post-fire restoration of important plant communities and prescribe vegetation treatments related to burned area rehabilitation

II. Issues

The entirety of the Memorial burned over, though not all areas experienced the same soil burn severity or vegetation mortality.

Hazard trees along park roads and trails pose a threat to employee and visitor safety.

Post-fire invasion of exotic species, of special concern is the potential for insipient invasions of common invasive grasses and herbaceous plants often transported by firefighting equipment (most fire operations within the park occurred during initial attack and the early operational periods of extended attack and a weed wash system was not in use).

Post-fire increases in known exotic plant populations, in particular Lehmann lovegrass (*Eragrostis lehmanniana*) and Boer lovegrass (*Eragrostis curvula*), both warm season perennial bunch grasses that were a known problem in the park's grasslands in the vicinity of the former Montezuma Ranch.

A significant portion of the agaves burned in the park and the surrounding lands, potentially impacting the federally listed lesser long-nosed bat which feeds exclusively on the nectar of this plant and has a summer roost in the park.

III. Observations

A. Background Information

Vegetation Overview and Fire History

Excerpted from the NPS Biological Inventory for CORO (Schmidt 2007)

According to NPS (1998) and Ruffner and Johnson (1991), the Memorial contains four vegetation types: Oak-Mexican Piñon Pine-Juniper Woodland (evergreen woodland community), the most extensive community, occurs mainly on the north and southwest facing slopes of the Memorial; Grama Grass-Mixed Grass-Mixed Shrub Grassland (Chihuahuan semi-desert grassland community) occurs on the easternmost part of the Memorial; Velvet Mesquite-Mixed Short Tree Woodland (Desert Riparian Forest community) is found in the easternmost part of the Memorial along low elevation ephemeral drainages; and Arizona Sycamore-Arizona Walnut-Oak Riparian Forest (mixed broadleaf forest community) is found along Montezuma Canyon.

Fire suppression leads to an increase in woody plant species, eventually increasing the intensity of fires, such as the Peak Fire of 1988, which burned most of the Memorial (Ruffner and Johnson 1991). The fire varied from moderate to severe in intensity, in many places killing trees; it also appears to have led to an increase in grasses (Ruffner and Johnson 1991). Fires can also cause air quality and soil erosion problems and result in the loss or alteration of habitat for wildlife. Fire management is made difficult because of the Memorial's proximity to Mexican ejido (communal) lands, where there is no fire management plan and few resources for fighting fires. Coronado NM is part of the Huachuca Fire Partners group, which works with local, state, and federal agencies, as well as private landowners, to manage fires on a landscape scale, regardless of political boundaries (Barbara Alberti, pers. com.).

Non-Native Species

The most pressing non-native species issue at the Memorial is the spread of Lehmann lovegrass and other non-native grasses. Lehmann lovegrass has become the dominant grass on the southeast side of the Memorial where it has replaced many native grasses. This change in species composition can alter the fire regime of the area by supporting higher fire frequencies, thereby leading to other changes in vegetation composition and structure (Anable et al. 1992). However, abundance and species richness of some taxa, such as small mammals, may be higher in areas with Lehmann lovegrass.

Ruffner and Johnson (1991) mention that woody species, such as mesquite, may be increasing in the grassland areas of the park. Encroachment of woody vegetation into grasslands, with the subsequent loss of these grasslands and the species that depend on them, is a major natural resource issue in southern Arizona (NPS 2000, Taylor 2004). Ruffner and Johnson (1991) suggest that periodic fires, which kill off woody species' seedlings and saplings, are important to reducing encroachment and therefore restoring the semi-desert grasslands.

Past fire history and RX Fire at CORO

By Perry Grissom, Fire Ecologist, Saguaro National Park

The earliest record of a fire in the Memorial was in 1959. All fires occurring between 1959 and 1988 did not exceed 100 acres except for a fire in 1966 which burned 123 acres. In the recent past, the Peak fire in 1988 burned almost the entire the park. In 2006, two smaller fires occurred: the Montezuma (240 acres) and the 103 (335 acres). Two prescribed fires have been implemented at the Memorial, one was 11 acres and the other was 37 acres.

Fuel treatment programs have taken place, primarily the reduction of Lehmann lovegrass and woody shrub encroachment. Saguaro Fire Program has responsibility for CORO and implements the fuel reduction projects and prescribed burns. A 160 acre prescribed burn was planned for the spring of 2011 (East Forest Lane prescribed burn) however, weather conditions did not cooperate and the burn did not take place.

Pre-fire drought and frost effects on vegetation

The pre-fire vegetation in CORO was undoubtedly affected by recent drought conditions as described in this excerpt from a Fuels Advisory issued by Coronado National Forest in May 2011 (Leiendecker, 2011):

In 2010, the Coronado received above average precipitation across the entire Forest. The monsoon was particularly good with isolated areas on the Sierra Vista Ranger District reporting as much as 21 inches just in the month of July. This allowed for abundant growth of grasses and carrier fuels throughout the majority of the high desert of the Coronado. However, in the time since October 2010, the Coronado has been experiencing drought conditions, receiving only 1.43 inches of an average of 5.06 inches over the last six months. Meaning the Coronado over the last six months has only received 28% of average precipitation for this time period. The situation in 2011 has not improved with the Coronado receiving only an average of 0.79 inches of a 3.37 average, or 23% of annual precipitation between January and April.

Exacerbating the effects of the drought conditions, the area also experienced a severe freeze event as described by Schlichting:

The week of January 31 to February 6 was a record breaking week for low temperatures in SE Arizona. On February 3 Sierra Vista, Wilcox and Tombstone set all time cold records at 4, 3 and 8 degrees Fahrenheit respectively. The Bisbee-Douglass airport set an all-time record of 0 degrees on February 4. The weather station located at the visitor center in the park reached a low of 1 degree on February 3. The minimum temperature in the park did not return to above freezing levels until February 8. The freeze had the most detrimental effects on cacti and succulents, usually resulting in mortality. Hand planted agaves in the restoration area suffered almost 50% mortality. Many tree species including Mexican Blue oak (*Quercus oblongifolia*), Velvet mesquite (*Prosopis velutina*) and Emory oak (*Quercus emoryii*) suffered significant dieback on the smaller branches, and a shedding of evergreen leaves. After the frost, the extremely droughty conditions did not allow for the quick recovery and re-growth, leaving the trees in a weakened and vulnerable state.

Species of Conservation Concern

There are no federally listed endangered plants known to occur in the memorial. There are a number of state listed species of concern but due to the limited time to complete this assessment they were not identified post-fire.

Agave (*Agave parryi*), a native desert succulent, produces nectar that serves as the primary food source for the federally listed endangered lesser long-nosed bat (*Leptonycteris curasoae yerbabuenae*). This bat species occurs within the memorial, most notably a late-summer roost at the State of Texas Mine which seasonally supports > 20,000 bats. This mine is closed with a bat gate and regularly monitored by the Arizona Game and Fish Department. There is no designated critical habitat for this species and therefore primary constituent elements have not been described. The bat serves as the primary pollinator for the agave, which must be pollinated to support reproduction by seeding, though the species also has the capacity for vegetative reproduction by producing pups adjacent to the parent plant. The 5 year review of the bat by the US Fish and Wildlife Service identified catastrophic fire and a changing fire regime resulting from non-native, invasive plants as threats to the recovery of the species. There is an ongoing project to establish 8 acres of agave in CORO as a requirement of the biological opinion issued by the USFWS for the border fence construction. The project documents and the experience of the project biologist, Dean Schlichting, provide valuable information to be considered in efforts to restore agave after the fire.

The following rare plants occur in CORO: *Astragalus hypoxylus*, *Pectis imberbis*, and possibly *Echinocereus coccineus* var. *arizonicus* (the taxonomic status of this population is not settled).

Mexican spotted owls (*Strix occidentalis*) nest in both the Chiricahua and Huachuca Mountains and these areas provide the necessary resources for this species. Although rare in Sonora, they have been found in the Sierra Madre in coniferous and pine-oak woodland and are probably residents of the higher mountain ranges (Russell and Monson 1998). MSO habitat is marginal in the park; however, CORO has one identified Protected Area Core. Habitat for the MSO in CORO is primarily Douglas-fir (*Pseudotsuga menziesii*) and Arizona white oak (*Quercus arizonica*).

B. Reconnaissance Method

Information in this assessment has been compiled by S. Dingman from various sources, some of which included field observations and some did not. There were no aerial observations made.

James Leckie was assigned to the Monument Fire incident and due to his previous knowledge of the park's flora and his responsibilities for the parks fire effects monitoring plots, he made note of several observations while conducting daily suppression operations in and around the Memorial.

Sarah Studd provided information and data regarding the pre-fire vegetation map and analysis of the vegetation alliances by soil burn severity.

Sandee Dingman and Dana Backer made limited field reconnaissance, mostly focusing on the grasslands area and the proposed restoration treatment.

Hazard trees were assessed on the ground by NPS trail crew and/or assigned fire personnel.

Other information was obtained from electronic data sources, expert opinion (Michele Girard, Dean Schlichting, and Danielle Foster), and the Forest Service BAER Report completed for their portion of the Monument Fire.

C. Findings

Provisional listing of Vegetation Associations

By Sarah Studd et al, Sonoran Desert Network Vegetation Mapping Inventory, July 10, 2011

The I & M Vegetation Map for CORO was in the final stages of completion just prior to the fire.

(Types have been created from polygon listings of dominants and common associates and brief descriptions. These descriptions have not been fleshed out with quantitative plot data.)

Woodlands

[Pinus discolor- Quercus emoryi- Quercus arizonica] woodland

This a variable community tied together by the consistent occurrence of the three dominant tree species. The polygons are found on multiple aspects throughout the park. They are often on steep slopes and sometimes correlated with minor drainages. The three dominant species are interchangeable in order. Shrub species are heterogeneous and vary through the examples. *Rhus virens* and *Cercocarpus montanus* are occasional associates. *Bouteloua curtipendula* is the most commonly listed dominant grass species.

[Quercus arizonica- Quercus emoryi] woodland

This woodland occurs in drainages or on low grade slopes with, generally, a north-facing component. Vegetation is usually 4-5m tall trees with an open sub-canopy and a heterogeneous mix of native grasses. The primary dominance rank is interchanged between the two oak species. Woody monocots *Nolina microcarpa* and *Dasyllirion wheeleri* are common associates as well as: *Rhus virens*, *Brickellia californica*, *Baccharis bigelovii*, *Arctostaphylos pungens*. Common dominant grasses are: *Bouteloua curtipendula*, *Muhlenbergia emersleyi*. *Aristida schiedneana*, and *Schizachyrium cirratum*.

Quercus arizonica- Quercus hypoleucoides- (Pinus discolor)/ [Muhlenbergia longiligula- Muhlenbergia emersleyi] woodland

This community occurs on steep and loosely rock-covered slopes and drainages in western Montezuma Canyon. The community is found on both north- and south-facing aspects. *Quercus arizonica* is a consistent dominant. *Quercus hypoleucoides* ranges from tree to shrub habit. *Pinus discolor* is a common associate and sometimes tertiary dominant. *Garryea wrightii* and *Rhus virens* are consistent shrub associates. *Muhlenbergia longiligula* and *Muhlenbergia emersleyi* often trade dominance and are joined by associate *Bouteloua curtipendula*.

Quercus arizonica- Robinia neomexicana/ Philadelphus microphyllus- Rhus aromatica woodland

This unique community occurs only once in CORO—just below Bob Thompson Peak in a small, scree-filled, south-facing bowl. *Quercus arizonica* is distributed throughout the small area and *Robinia neomexicana* grows on the edges of the talus field. *Philadelphus microphyllus* grows as a robust shrub in dense patches within the talus field. *Rhus aromatica* and *Brickellia californica* are common throughout.

Muhlenbergia emerseleyi grows on the more stable surfaces and Bouteloua curtipendula on the scree.

***Quercus oblongifolia- Quercus emoryi/ Bouteloua curtipendula* Woodland/tree savanna**

This community occurs in the eastern portion of Montezuma Canyon on multiple aspects. Polygons often include multiple drainages. This community generally occurs on gradual slopes of 25% grade or less and does not extend up onto the steep slopes of 60%. Both Quercus species occur in all polygons and sometimes their abundance shifts. Shrubs are rarely dominant. Mimosa aculeaticarpa, Rhus virens, Gaurdiola platyphylla, Eysenhardtia orthocarpa, Brickellia californica, and Arctostaphylos pungens all occur occasionally. Bouteloua curtipendula is the most consistently occurring of many grass species. Bothriochloa barbinodis, Schizachyrium cirratum, Heteropogon contortus, Muhlenbergia emerseleyi, and Eragrostis lehmanniana are common associates or lesser dominants.

Wooded shrublands

***Pinus discolor / Quercus toumeyii* Woodland/wooded shrubland**

This community is found at the higher elevations of CORO on the slopes of Montezuma Peak and the surrounding ridge. It occurs in areas of high slope and high bedrock cover. Pinus discolor is generally stunted in height. Common shrub associates or co-dominants are: Arctostaphylos pungens on bedrock outcrop edges and Cercocarpus montanus mixed within the bedrock areas. Muhlenbergia emerseleyi is a common associate bunch grass.

***Quercus emoryi/ Arctostaphylos pungens* Woodland/wooded shrubland/ tree savanna**

This community is found in the mid-elevations of CORO on slopes with a south-facing component. Quercus emoryi is accompanied by a changing mix of co-dominants and lesser associates. Quercus arizonica is most consistent. Pinus discolor and Juniperus deppeana are associates on the higher end of Montezuma Canyon. Quercus oblongifolia is an associate in the lower elevations on the more eastern end of Montezuma Canyon. Rhus virens, Brickellia californica, and Ericameria laricifolia are common shrub associates. Muhlenbergia emersleyi is a common grass associate and is joined by a heterogeneous mix of grasses: Bouteloua curtipendula, Aristida schiedeana, Schizachyrium cirratum.

Shrublands

***Quercus arizonica/ Cercocarpus montanus- Garryea wrightii- Rhus virens- (Ericameria laricifolia)/ Muhlenbergia emersleyi- Bouteloua curtipendula* Shrubland/shrub savanna/wooded shrubland**

This shrubland stretches across the south-facing slopes of Montezuma Peak and its western ridge. Quercus arizonica is a consistent dominant or strong associate tree. At the upper reaches of Montezuma Ridge, it is shrub-like. Pinus discolor and Juniperus deppeana are the most common associate tree species. The sub-canopy densities vary with topography and ground cover. Cercocarpus montanus is densest in areas of emergent bedrock. Garryea wrightii and Rhus virens do well in loose, rocky areas. Ericameria laricifolia becomes dense (joined by Nolina microcarpa) when the ridge slope includes open bowls. Grass is densest there as well: Muhlenbergia emersleyi and Bouteloua curtipendula are common.

***Cercocarpus montanus- Fouquieria splendens/ Aristida purpurea- Bouteloua curtipendula* Shrubland/shrub savanna**

This community is confined slopes and minor hill shoulders where sedimentary bedrock bedding

planes emerge ground level. *Fouquieria splendens* is generally the most abundant plant, but *Cercocarpus montanus* often generates as much cover as a more robust shrub. *Dasyilirion wheeleri* and *Opuntia phaeacantha* are common associates and *Rhus virens* is a large shrub but more rare. Grasses are a heterogeneous mix: *Aristida purpurea*, *Bouteloua curtipendula*, *Leptochloa dubia*, and *Erioneuron avenaceum* are the most common species.

***[Eysenhardtia orthocarpa- Aloysia wrightii]/ Eragrostis lehmanniana* Wooded shrubland/shrubland /shrub savanna**

This community is found on the upper slopes and ridge crests in lower Montezuma Canyon on slopes with a south-facing component. Intrusive igneous (granitic) bedrock is often emergent, especially at the shoulders and crests. Trees are occasional and are often present as interlopers from nearby polygons. *Eysenhardtia orthocarpa* and *Aloysia wrightii* trade occurrence. Both are densest around rock outcrops. *Aloysia wrightii* increases in density in minor drainages and draws. Neither species is dominant in all examples. Associate shrubs are: *Brickellia californica*, *Gaurdiola platyphylla*, *Ericameria laricifolia*, *Dasyilirion wheeleri*, and *Baccharis sarothroides*. The abundance of the invasive *Eragrostis lehmanniana* is common among the polygons. *Bothriochloa barbinodis* is a tall enough grass to stand out above the sea of *Eragrostis*.

***Eysenhardtia orthocarpa- (Rhus virens)/ Leptochloa dubia- mixed grasses* Shrubland/shrub savanna**

This community is found on slopes where exposed sedimentary bedrock is common. *Eysenhardtia orthocarpa* grows in patches especially near the emergent rock and is the most common shrub of a consistent group of many species: *Rhus virens*, *Cercocarpus montanus*, *Aloysia wrightii*, *Dasyilirion wheeleri*, and *Agave palmeri*. Grasses are also a mix of many species. *Leptochloa dubia*, *Lycurus setosus*, *Elionurus barbiculmis*, *Muhlenbergia emersleyi*, and *Bothriochloa barbinodis* are all found within the community.

Savannas

***Calliandra eriophylla- Agave palmeri/ Eragrostis lehmanniana- mixed native grasses* Shrub savannas/herbaceous areas**

This rare community is found on minor slopes and interfluvial rises at the mouth of Montezuma Canyon. The ground cover is a red, loose rock. *Calliandra eriophylla* and *Agave palmeri* are short plants just rising above the mix of grasses. This community has dominant *Eragrostis lehmanniana*, but its presence seems to be somewhat suppressed by the continued presence of a mix of natives, perhaps abetted by the rockier ground cover. *Hilaria belangeri*, *Heteropogon contortus*, *Aristida ternipes*, and *Bothriochloa barbinodis* are common associates.

***(Prosopis velutina- Baccharis sarothroides)/ Eragrostis lehmanniana* Tree savanna/herbaceous areas**

This community is primarily defined by its abundance of invasive *Eragrostis lehmanniana*. It occurs on disturbed flats and footslopes at the mouth of Montezuma Canyon. *Prosopis velutina* is of variable habit: it is sometimes considered a tree. *Baccharis sarothroides* is a common associate as well, especially common in the open plains. *Eragrostis lehmanniana* abundance is greatest in the bare soil-covered plains; on hill slopes, where soil is perhaps less disturbed and there is greater rock and gravel cover, native grasses create additional field cover among the *Eragrostis*. These less common associates are: *Heteropogon contortus*, *Aristida ternipes*, and *Bothriochloa barbinodis*. *Calliandra eriophylla* is often found nestled below the taller grasses.

[Quercus arizonica- Quercus emoryi]/ Bouteloua curtipendula- Muhlenbergia emersleyi- Bothrichloa barbinodis Tree savanna

This community is a more open and grassy version of the common Quercus spp. woodland. These communities are found on slopes of multiple aspects in the mid to upper elevations of CORO. The two Quercus spp. here trade dominance. Associate sub-canopy species vary with ground cover. Areas with higher bedrock content include Ericameria laricifolia, occasional Cercocarpus montanus, and Eysenhardtia orthocarpa. Woody monocots are often present. The three dominant grasses are consistent through all examples. Common associates are: Elionurus barbiculmis, Leptochloa dubia, Schizachyrium cirratum, Heteropogon contortus, and Aristida spp.

The above vegetation associations were geospatially analyzed to determine relationships with soil burn severity classes as determined by the US Forest Service BAER Team. The spatial analysis was performed by the Sonoran Desert I&M program. Statistics were analyzed in Excel using a pivot table. The Vegetation Map data does not exist for the entire park yet; however, totals are based on existing Veg Map data. The Gridcode is the soil burn severity classes defined by the USFS referring to the 256 BARC map (see watershed assessment for more information about BARC maps) break points: unchanged/low = 0-71; low = 71-106; moderate = 107-155; high > 156.

Prov_Assoc	Soil burn severity	Acres	Hectares
(Prosopis velutina- Baccharis sarothroides)/ Eragrostis lehmanniana	Unchanged	0.42	0.169903
	Low	103.35	41.824087
	Moderate	84.55	34.2147149
(Prosopis velutina- Baccharis sarothroides)/ Eragrostis lehmanniana Total		188.32	76.2087049
[Eysenhardtia orthocarpa- Aloysia wrightii]/ Eragrostis lehmanniana	Unchanged	21.78	8.813156
	Low	70.69	28.60898187
	Moderate	57.13	23.1208644
[Eysenhardtia orthocarpa- Aloysia wrightii]/ Eragrostis lehmanniana Total		149.60	60.54300227
[Pinus discolor- Quercus emoryi- Quercus arizonica]	Unchanged	25.80	10.44276799
	Low	105.10	42.5311418
	Moderate	31.67	12.8173479
[Pinus discolor- Quercus emoryi- Quercus arizonica] Total		162.57	65.79125769
[Quercus arizonica- Quercus emoryi]	Unchanged	18.63	7.53957
	Low	39.081	15.8158332
	Moderate	89.36	36.164247
[Quercus arizonica- Quercus emoryi] Total		147.08	59.5196502
[Quercus arizonica- Quercus emoryi]/ Bouteloua curtipendula- Muhlenbergia emersleyi-	Unchanged	0.35	0.14309659

Bothrichloa barbinodis	Low	236.12	95.5547672
	Moderate	80.56	32.60197652
[Quercus arizonica- Quercus emoryi]/ Bouteloua curtipendula- Muhlenbergia emersleyi- Bothrichloa barbinodis Total			
		317.03	128.2998403
Calliandra eriophylla- Agave palmeri/ Eragrostis lehmanniana- mixed native grasses	Low	169.76	68.7010685
	Moderate	77.93	31.5384898
Calliandra eriophylla- Agave palmeri/ Eragrostis lehmanniana- mixed native grasses Total			
		247.70	100.2395583
Cercocarpus montanus- Fouquieria splendens/ Aristida purpurea- Bouteloua curtipendula	Low	5.93	2.399439
	Moderate	4.94	1.99932
Cercocarpus montanus- Fouquieria splendens/ Aristida purpurea- Bouteloua curtipendula Total			
		10.87	4.398759
E_(Prosopis velutina- Baccharis sarothroides)/ Eragrostis lehmanniana	Unchanged	1.35	0.545615378
	Low	130.45	52.79225717
	Moderate	173.62	70.261902
E_(Prosopis velutina- Baccharis sarothroides)/ Eragrostis lehmanniana Total			
		305.42	123.5997745
E_[Eysenhardtia orthocarpa- Aloysia wrightii]/ Eragrostis lehmanniana	Low	1.03	0.417563
	Moderate	5.32	2.15429
E_[Eysenhardtia orthocarpa- Aloysia wrightii]/ Eragrostis lehmanniana Total			
		6.36	2.571853
E_[Pinus discolor- Quercus emoryi- Quercus arizonica]	Unchanged	15.02	6.0787002
	Low	26.32	10.6494958
	Moderate	2.18	0.880517
E_[Pinus discolor- Quercus emoryi- Quercus arizonica] Total			
		43.51	17.608713
E_[Quercus arizonica- Quercus emoryi]	Unchanged	0.36	0.145522
	Low	4.11	1.66575
	Moderate	8.14	3.29533
E_[Quercus arizonica- Quercus emoryi] Total			
		12.62	5.106602
E_[Quercus arizonica- Quercus emoryi]/ Bouteloua curtipendula- Muhlenbergia emersleyi- Bothrichloa barbinodis	Unchanged	0.66	0.26863573
	Low	41.70	16.8767875
	Moderate	16.63	6.731303
E_[Quercus arizonica- Quercus emoryi]/ Bouteloua curtipendula- Muhlenbergia			
		59.00	23.87672623

emersleyi- Bothrichloa barbinodis Total			
E_Calliandra eriophylla- Agave palmeri/ Eragrostis lehmanniana- mixed native grasses	Low	8.46	3.42495318
	Moderate	25.32	10.24568
E_Calliandra eriophylla- Agave palmeri/ Eragrostis lehmanniana- mixed native grasses Total		33.780	13.67063318
E_Eysenhardtia orthocarpa- (Rhus virens)/ Leptochloa dubia- mixed grasses	Unchanged	13.36	5.4063748
	Low	9.76	3.95018912
E_Eysenhardtia orthocarpa- (Rhus virens)/ Leptochloa dubia- mixed grasses Total		23.12	9.35656392
E_Pinus discolor/ Quercus toumeyi	Unchanged	3.70	1.4967074
	Low	12.67	5.12504
	Moderate	0.36	0.14728205
E_Pinus discolor/ Quercus toumeyi Total		16.73	6.76902945
E_Quercus arizonica- Quercus hypoleucoides- (Pinus discolor)/ [Muhlenbergia longiligula- Muhlenbergia emersleyi]	Low	1.91	0.7726913
	Moderate	14.42	5.83411
	High	0.01	0.0030949
E_Quercus arizonica- Quercus hypoleucoides- (Pinus discolor)/ [Muhlenbergia longiligula- Muhlenbergia emersleyi] Total		16.33	6.6098962
E_Quercus arizonica/ Cercocarpus montanus- Garryea wrightii- Rhus virens- (Ericameria laricifolia)/ Muhlenbergia emersleyi- Bouteloua curtipendula	Unchanged	18.08	7.317077
	Low	172.97	69.999222
	Moderate	88.22	35.7007234
	High	0.97	0.392696
E_Quercus arizonica/ Cercocarpus montanus- Garryea wrightii- Rhus virens- (Ericameria laricifolia)/ Muhlenbergia emersleyi- Bouteloua curtipendula Total		280.24	113.4097184
E_Quercus emoryi/ Arctostaphylos pungens	Unchanged	0.28	0.111565
	Low	9.82	3.9759329
	Moderate	83.80	33.9109788
E_Quercus emoryi/ Arctostaphylos pungens Total		93.90	37.9984767
E_Quercus oblongifolia- Quercus emoryi/ Bouteloua curtipendula	Unchanged	0.30	0.121405
	Low	51.29	20.75650874
	Moderate	135.17	54.70181781
E_Quercus oblongifolia- Quercus emoryi/		186.76	75.57973155

Bouteloua curtipendula Total			
Eysenhardtia orthocarpa- (Rhus virens)/ Leptochloa dubia- mixed grasses	Unchanged	21.00	8.498675882
	Low	164.11	66.412108
	Moderate	2.37	0.9575484
Eysenhardtia orthocarpa- (Rhus virens)/ Leptochloa dubia- mixed grasses Total		187.47	75.86833228
Pinus discolor/ Quercus toumeyi	Unchanged	9.40	3.8021544
	Low	83.37	33.73784
	Moderate	17.35	7.0204755
Pinus discolor/ Quercus toumeyi Total		110.11	44.5604699
Quercus arizonica- Quercus hypoleucoides- (Pinus discolor)/ [Muhlenbergia longiligula- Muhlenbergia emersleyi]	Unchanged	13.03	5.273452815
	Low	42.28	17.10925484
	Moderate	88.36	35.7601077
	High	3.30	1.3349527
Quercus arizonica- Quercus hypoleucoides- (Pinus discolor)/ [Muhlenbergia longiligula- Muhlenbergia emersleyi] Total		146.97	59.47776806
Quercus arizonica- Robinia neomexicana/ Philadelphus microphyllus- Rhus aromatica	Low	0.95	0.383372
	Moderate	0.05	0.0219415
Quercus arizonica- Robinia neomexicana/ Philadelphus microphyllus- Rhus aromatica Total		1.00	0.4053135
Quercus arizonica/ Cercocarpus montanus- Garryea wrightii- Rhus virens- (Ericameria laricifolia)/ Muhlenbergia emersleyi- Bouteloua curtipendula	Unchanged	51.37	20.78793051
	Low	282.42	114.2927879
	Moderate	110.90	44.878821
	High	0.26	0.106469
Quercus arizonica/ Cercocarpus montanus- Garryea wrightii- Rhus virens- (Ericameria laricifolia)/ Muhlenbergia emersleyi- Bouteloua curtipendula Total		444.95	180.0660084
Quercus emoryi/ Arctostaphylos pungens	Unchanged	10.07	4.076528
	Low	200.09	80.975232
	Moderate	198.12	80.1757825
Quercus emoryi/ Arctostaphylos pungens Total		408.28	165.2275425
Quercus oblongifolia- Quercus emoryi/ Bouteloua curtipendula	Unchanged	0.14	0.05534275
	Low	155.94	63.10867592
	Moderate	322.48	130.5020682
Quercus oblongifolia- Quercus emoryi/		478.56	193.6660869

Bouteloua curtipendula Total		
Grand Total	4078.28	1650.430012

Effects of the Monument Fire on important plant species/communities

This section was written by James Leckie, minor edits by S Dingman.

CORO is home to twelve native species of oaks. Of those 12 the three most common tree-form oaks are Arizona white oak (*Quercus arizonica*), Emory oak (*Quercus emoryi*) and Mexican blue oak (*Quercus oblongifolia*). These oaks all respond similarly to fire. In general these slow growing trees are fire adapted to fast moving, low residence time fires commonly associated with grass fires. More severe and longer duration fires may top-kill these species starting with the younger, smaller diameter trees first. Of these oaks, the Mexican blue is the most susceptible to this form of damage. All these oaks tend to re-sprout vigorously after all but high intensity fire, which can root-kill the tree. Acorns have a thin skin and exposed acorns do not survive fire. The last significant fire to sweep through CORO was the Peak Fire in June of 1988 which burned the majority of the Memorial.

During a normal year I would expect the oaks in the grasslands of the eastern portions of CORO to come back nicely after the fire. Intensities were not great and the fire appeared to move swiftly through the grass. Approaching the visitor center and to its west on the south side of the road I expect a more mixed response. Here the fire transitioned from a moderate intensity ground fire to a crown fire and I would expect a substantial portion of those oaks to be top killed with a significant percentage of the younger trees root-killed as well. North of the road I anticipate the same response but to a lesser degree creating a mosaic of top-killed re-sprout and oaks leafing out from existing branches with interspersed root-killed trees. Just south of Montezuma Pass below the Joe Canyon trail the fire burned very hot and I think we will see most of the oaks in this area root-killed. Oaks in drainages along Montezuma Canyon road and those associated with the Mexican spotted owl PAC should remain predominantly intact as well as the area directly north of Montezuma Pass.

Having said that, the 12 months or so leading up to the Monument fire were not normal due to the drought and freeze effects described above. Live fuel moistures were at the 90th percentile (Leienhecker, 2011). The seasonal heating up and month-long series of wind events further exacerbated the situation. It is without a doubt that the vegetation at CORO was severely stressed prior to the fire. The fire could be the final straw for many of the oaks. Alternatively due to the severe weather conditions leading up to the fire many of the trees were still dormant when the fire passed through. This can afford them some degree of protection by not having further resources consumed. Overall I would think that much of the previous tree-form strata at CORO will gain a significant shrub component as the top-killed oaks re-sprout.

Manzanita (*Arctostaphylos pungens*): Manzanita is killed by fire. Seeds are serotinous and need a moderate to high intensity fire to germinate. From this standpoint the Monument Fire should benefit recruitment of manzanita in many areas of the memorial; unfortunately the existing manzanita in many areas should have perished in the flames which potentially will reduce the root structures holding the soil in place.

Agave (*Agave parryi*): An experimental burn was conducted on approximately 35 acres of non-native

grassland on the southeast corner of the memorial in June 2009 under somewhat similar burning conditions (slightly lower temp, slightly higher RH and probably less wind) as the Monument Fire. One-year post-burn reads were conducted in 2010 and showed a 27% mortality rate of agave (Grissom pers. comm.). The unit was infested with Lehmann lovegrass (*Eragrostis lehmanniana*), a non-native grass that increases fire intensity and therefore agave mortality. The unit contained very low densities of agave, less surface rock (to break up the fuel load) and had a higher concentration of Lehmann than the surrounding grasslands at CORO. With the more continuous and higher fuel loads (3.5 tons/acre-Grissom 2011) in and around the experimental burn unit it is expected that agave mortality from the fire will be similar or higher than that of the experimental burn.

Potential for invasive plant species to establish in the burned area

By Dana Backer with input from A. Hubbard

CORO has relatively few non-native invasive plants however, one non-native perennial grass, Lehmann lovegrass (*Eragrostis lehmanniana*), was widespread throughout the park and dominated the southeast side of the Memorial. Lehmann lovegrass and to a lesser extent Boer lovegrass (*Eragrostis curvula*), have altered the species composition and structure of the former semidesert grassland. Both of these non-native grasses respond favorably to fire, by resprouting and seed germination. Lehmann lovegrass can reach density and pre-fire fuel loads in 2 to 3 years (Uchtyl 1992). Lehmann and Boer lovegrasses have a high likelihood of expanding its range within CORO.

Two species of Russian thistle (*Salsola kali* and *Salsola tragus*) present in the park pre-fire are likely to re-establish and they have the potential to spread post-fire. Other non-native plants that were present pre-fire and have the potential to re-establish include several mustards (*Brassica tournefortii*, *Descurainia sophia* and *Sisymbrium irio*), filaree (*Erodium cicutarium*), yellow sweet clover (*Melilotus indicus*), black medick (*Medicago lupulina*), sowthistles (*Sonchus asper* and *Sonchus oleraceus*), common mullein (*Verbascum thapsus*) and several of the grasses (*Eragrostis cilianensis*, *Hordeum murinum* spp. *glaucom*, *Bromus catharticus*, and *Lolium perenne*).

There are a few potentially invasive non-native plants that are not currently listed on the Biological Inventory (2007) but could establish post-fire include red brome (*Bromus rubens*), horehound (*Marrubium vulgare*), Maltese star-thistle (*Centaurea melitensis*) and African lovegrass (*Eragrostis echinochloidea*). There is the potential for any number of new species to appear post-fire because of the equipment, personnel, and resources that were present during initial attack. Former Chief of Resources was concerned about the establishment of Mediterranean lovegrass (*Eragrostis barrelieri*).

Hazard Trees

By S. Dingman

Numerous hazard trees were felled during fire suppression activities and immediately after while fire suppression personnel were staged in the park by the IMT in order to provide for safe working conditions for fire personnel. As there were numerous people directing this work intermittently over a period of a few weeks it is impossible to provide an exact tally after the fact. Jeremy Curtis, Chief of Facilities Management, estimates 80 trees total were removed to date to clear roads, some trails, and primary visitor use facilities. It is anticipated that additional trees will become hazards and warrant removal in the future as they succumb to mortality or are damaged as a result of delayed effects of fire

and/or post-fire watershed events.

Plant communities/locations important to wildlife

Compiled by S Dingman from multiple sources

Mexican spotted owl: Loss of important structural elements such as downed woody debris, snags, and canopy cover will reduce suitability in the short and long-term for the individuals within these territories. After the monsoon season, it will be more evident how much of the oak component was lost as a result of the fire. Individual fitness may be compromised as a result of fire effects and habitat loss. Habitat recovery is expected to be slow in these sky island ecosystems and may affect individual fitness for the long-term. The PAC located within the memorial experienced low to moderate burn severity and is expected to continue to provide suitable habitat (personal observation, M. Girard).

Lesser long-nosed bat: Lesser long-nosed bats roost in caves and mines and forage primarily in agave flower nectar and pollen, serving as the pollinator for the agave. There is a major roost site at the State of Texas mine in CORO, seasonally supporting > 20,000 bats. Observations made by Dr. Joel Diamond, Arizona Game and Fish Department, after the fire found that the State of Texas roost was occupied as of July 5, 2011 and there was indication of agave food source in the fresh guano so there are some plants in the vicinity still producing nectar immediately after the fire. However, many agave plants were lost throughout the burned area, both in CORO and on adjacent lands that might also serve as foraging habitat for the colony in State of Texas Mine. A reduction in foraging habitat availability (i.e. agave plants) within the burned area is expected for several years. Because foraging habitat was lost, individual bats may have to travel farther to find suitable foraging locations. Some agave may survive and others will die as a result of the fire, such responses are expected to vary by plant size, fire intensity, and soil burn severity. Additional agave may be lost in post-fire floods and/or debris flows.

Opportunity and Techniques for Grassland Restoration

The fire presents an unanticipated opportunity to re-establish a native desert grassland with agave. The primary concern is that the Lehmann lovegrass invasion in the grasslands increases fire intensity which increases agave mortality, which then has a negative impact on the endangered lesser long-nosed bat. The re-establishment of a native grassland would mitigate those impacts.

The proposed method for restoration is the use of “fertile islands” which is a restoration technique used in desert landscapes. The description of this technique and its ecological theory is briefly described in this an excerpt from Abella et al. (in review):

The concept of fertile island as a means of native plant restoration is a common practice in the desert restoration. Fertile islands are areas of ameliorated environmental conditions. They are small areas within a larger landscape in which restoration (planting, seeding, mulching, etc.) occurs. These islands then serve as a source population for the larger area either through granivores or wind dispersal. Early successional seeds and late successional plants are often part of the matrix.

While plant size often determines competitive ability in more mesic ecosystems, other traits such as canopy architecture, timing of germination, and soil modification related to fertile islands (resulting in facilitation rather than competition) may be more important in deserts.

Therefore, earlier successional communities that potentially create a higher, less patchy cover may indeed be more effective in limiting exotic species establishment through competitive effects, whereas late-successional scrub communities provide little competitive effect in interspaces (a majority of the space) and facilitative effects within fertile islands beneath shrubs (Rodríguez-Buriticá & Miriti 2009).

Supplemental water for establishment of native desert plants is a restoration technique subject to debate. In brief, the concern is that plants that are provided supplemental water typically have higher initial survivorship but may not develop adequate root structure to become drought hardy enough to be independent from supplemental water. There is also concern that succulents that are routinely provided supplemental water are more vulnerable to frost damage due to their engorged state when a freeze occurs whereas succulents without supplemental water are may be less susceptible to damage. This was the pattern observed by Schlichting following the February 2011 freeze event.

Supplemental water techniques are highly varied. One approach used in arid land restoration at Lake Mead NRA, Joshua Tree National Park, and other parks use of DriWater, a self-contained time-release water gel. Tubes that hold the gel packets, are inserted into the planting hole at the time of planting according to the label instruction (see Supporting Documentation) and 30 day gel inserts are used to mitigate transplant shock with time release water delivered to the root zone. After that, the decision to add new gel packs should be made locally and based on natural precipitation. If supplemental water is warranted a new gel pack is installed in the existing tube. Tubes can be left in place indefinitely, but typically 1-3 years, until the plant is well established. After that the tubes are simply lifted out of the ground the hole is refilled with native dirt. Irrigation, either drip or above ground is also used to establish native vegetation, particularly riparian trees, but has the disadvantage of encouraging wide spread weed growth, needing a pump and well which are also subject to failure due to animal predation or photo degradation, and are unsightly. Another option is hand watering during times of drought, but this option is very labor intensive and requires water transport and personnel to deliver the water to the plants so is not recommended for restoration sites that are difficult to access. At CORO, a recent agave planting project did not use supplemental water and experienced a 55% mortality on first year plantings which is attributed by Girard to the combined effects of prolonged drought and freeze effects.

Control of herbivores, namely deer, and concern for structural damage caused by gophers is also a concern for outplanted species. At the CORO agave mitigation project, chicken wire cages are constructed and inserted on top of the outplanted agave and a nylon coated wire mesh “bag” called a gopher guard is inserted around the root ball at the time of planting. These techniques are labor intensive to build, install, and maintain. Schlichting has observed that the deer can still pull up the above ground cages and have even pulled out the below ground root guards. There is also concern that the below ground gopher guards may interfere with normal root development if they do not decompose quickly as the manufacturer claims. Incidentally, one gopher guard recently came out of the CORO agave mitigation project after a year in the ground and shows almost no signs of decomposition. Finally, there is the additional labor involved with eventually removing herbivory cages after they are no longer needed and before they interfere with plant growth, which is sometimes problematic with short-term project funds and staff turn-over. An alternative herbivory control method is to use Critter-out, a chemical spray diluted from concentrate that repels a wide range of mammalian pests. The spray is applied at the time of planting and can be re-applied in the future if necessary; the effects generally last for 30 days in arid conditions, less when rainfall is more frequent. Lake Mead NRA uses Critter-out for some outplanting/transplanting purposes and finds it to be both effective and cost-effective. (See

Supporting Documentation, example Standard Operating Procedure for Outplanting).

Seeding native species is often constrained by seed availability. For large scale restoration using specific species and/or genotypes typically a seed increase is needed, requiring seed collection of desired species in year one, establishment of seed increase beds in year 2, and harvest in year 3. For many species, especially perennials, seed yield is often low initially but will increase in future years. Greg Eckert with the NPS Natural Resources Program Center has identified established seed increase beds at the NRCS Las Lunas Plant Materials Center that were established for Carlsbad Caverns National Park a few years ago, have been harvested, and will be plowed under unless another NPS unit wants the same seed. The species available and their yields are listed below. All listed species are widely distributed, wind pollinated species that are known to occur in CORO and have been determined to be suitable for use in this park based on growing conditions (personal opinion, Dingman, Schlichting, Backer, Girard).

Common Name	Scientific Name	Agreement Acreage	2010 LLPMC Acreage	Clean Seed (Bulk lbs.)
Blue grama	<i>Bouteloua gracilis</i>	0.50 acre	0.50 acre	3.54
Green sprangletop	<i>Leptochloa dubia</i>	0.50 acre	0.50 acre	33.32
Plains bristlegrass	<i>Setaria vulpiseta</i>	0.50 acre	0.90 acre	77.88
Sideoats grama	<i>Bouteloua curtipendula</i>	0.50 acre	0.50 acre	19.96
Purple three-awn	<i>Aristida purpurea</i>	0.50 acre	0.50 acre	8.20

The point of contact at Las Lunas Plant Material Center is Greg Fenchel. Additional information has been requested regarding cost and probable yield. As these seed increase beds are already managed under an existing interagency agreement between NRCS and NPS, it is anticipated that the additional administrative work to maintain and harvest the fields for CORO use would be minimal. The Tucson Plant Material Center has some foundation seed fields, growing a wider variety of grasses; forbs are available from local seed vendors. The point of contact is Manuel Rosales.

IV. Recommendations

A. Emergency Stabilization

ES 2 Refine Watershed Assessment: The nature of this BAER plan assessment precluded the opportunity to conduct a complete vegetation mortality assessment. Of particular concern is the survivorship of agave given its importance to the persistence and recovery of the federally listed endangered lesser long-nosed bat. The I&M Upland Vegetation and Soil Monitoring program had recently installed and read 38 plots, providing an outstanding and highly coveted opportunity to complete a high resolution soil burn severity map and vegetation mortality map. These products will be critical to understanding and responding appropriately to the short-term and long-term effects of this fire on the scale that is informative to the resource stewardship decisions that are required.

ES 5 Remove Hazard Trees: Most of this immediate work has been completed by fire crews working in the park during the suppression incident. However, local maintenance staff should review the roads,

trails, and buildings to make sure all hazards have been removed. The remaining woody debris, particularly in the picnic area, should be removed from the park or chipped in place. In the future, it is expected that additional trees may become hazardous as they succumb to the delayed effects of fire-induced mortality or are damaged by post-fire watershed events. As a result maintenance of the hazard tree treatment should be included for FY12, FY13, and FY14.

B. Burned Area Rehabilitation

BAR 1 Early Detection and Eradication of Insipient Invasions: Roads, trails, and parking lots were used throughout the fire incident as control lines, staging areas, etc. There was no weed wash system in place for incoming fire suppression equipment and many access routes around this fire required travel along farm roads with weedy ditches. There is a potential that new weed species or new populations of known weed species may become established along pathways vectors. These insipient invasions should be treated prior to seed dispersal using a treatment method appropriate to the site, environmental conditions, and species. There is also likely a latent seedbank that contains at least some weedy species that may now germinate and exacerbate existing problems, particularly in the old grazing area on the southeast side of the park where invasive lovegrasses have long been a major component of the landscape. An integrated pest management approach should be used to control and contain the spread of established weed populations into the burned area, typically controlling spread along the leading edge of invasion or protecting specific vulnerable sites, such as the agave mitigation plot and the grassland restoration area proposed in BAR 2. The Sonoran Desert I&M program should be utilized to provide the survey work as they have recently established an invasive plant monitoring protocol. For FY12, 13, and 14 it would be desirable to have some in house capability for this work, ideally a GS-7 Lead Biotech and two GS-5 biotechs that can work on this as well as other BAER treatments.

BAR 2 Restore Grasslands and Agave: This is a rare opportunity to actively restore a degraded grassland with agave for the direct benefit of a federally listed endangered species. The park has over 100,000 previously collected agave seed available for use, the Tucson Plant Material Center is already working under an existing agreement to propagate agave for a border fence mitigation project and can easily add on the additional work both functionally and administratively, and the Los Lunas Plant Material Center already has seed increase beds established and available for six common grass species appropriate to the Memorial. Furthermore, the lessons learned in the border fence agave mitigation project as well as recent research on agave and grassland restoration at nearby Fort Huachuca provides ample expertise to devise a restoration strategy that is well thought out and likely to succeed. The proposed technique is to establish a 100 acre restoration area in which lovegrasses are controlled with herbicide and within that restoration area re-seed native grasses and perhaps other native plant species and outplant agave seedlings to create fertile islands. The use of DriWater is recommended to mitigate against unusual drought conditions and the use of Critter-out or similar chemical repellent is recommended if herbivory conditions warrant provided it is not used in areas that support agave still capable of flowering. In addition, it may be necessary to fence the restoration area to prevent ORV trespass by the Border Patrol, though the necessity and feasibility of fencing will be dependent up on site selection. The exact location and configuration for this treatment, as well as some additional cost estimates and proposed seed list (beyond the six grass species) needs to be considered using the following factors:

Spatial considerations:

Ecological Site Descriptions

Vegetation map
soil map
refined soil burn severity map
cultural sites
topography (and how it would inhibit off road vehicle use)
locations of all experimental, research and monitoring plots – RX fire, FHM, I&M, and independent research plots.
locations of future infrastructure – DHS, NPS, other
current/former infrastructure roads, trails, wells, outbuildings, etc.
UDI traffic focal areas

Non-spatial considerations:

Grazing/plowing history of the site
Veg map plot data to determine pre-fire species composition
Predicted agave survivorship post-fire
Research by Shelly Danzer from work at Fort Huachuca
Research by Erica Geiger using fire to control Lehmann lovegrass
Research by Linda Kennedy at the Audubon Research Ranch following the Ryan fire

C. Other Needs

The grazing situation needs to be investigated. The park is currently ungrazed but has historically been grazed and there has been some recent interest (before the fire) expressed by one operator in re-opening a grazing lease (pers. comm. Schlichting). It was beyond the scope of this assessment to sort out the legal status and procedures for grazing in this park. In any case, it is strongly recommended to deny all grazing requests (year-round or ephemeral) within the park for at least 3 years after fire to allow for natural vegetation recovery and to avoid damage to post-fire treatments. If grazing is allowed in the future, consideration should be given to fencing out the proposed agave/grassland restoration area.

Known populations of plant species of conservation interest (e.g. state listed species) should be surveyed to determine the extent to which they were affected by the fire and/or post-fire watershed events. Where feasible, action should be taken to mitigate damages. Both the assessment and any warranted treatments could be submitted as an emergency stabilization or burned area rehab treatment at a later date.

Pine bark beetles are present in the area and have the potential to damage and destroy Mexican spotted owl habitat. Risk to oaks is low and the PAC at CORO is primarily oak though there are a few vulnerable conifers as well. The park should consult with forest pest management specialist (APHIS, Forest Service, other) to determine the best course of action.

The fire burned several of the power poles within the park which were subsequently replaced by Sulfur Springs Valley Electric Cooperative resulting in soil and vegetation disturbance along 8091 linear feet. Damage was assessed by Dean Schlichting on July 7 and 8. In total there were 14 segments of trail, with a combined length of 8091 linear feet. These trails had varying degrees of rutting depending on the soil type and depth of each location. The worst of the trails was segment 6, which was on a decomposed granite soil. Most trails were on gravelly sandy loam soils and had moderate amounts of rutting and disturbance. The heaviest impacts were at the ends of the trails where power poles were replaced. Another item of concern is the old power line was left to lay in the trail (segment 5). GPS data of these

segments is on file in the biologist office at CORO. Due to the soft nature of these soils, a light raking and reseeding of these areas should suffice with a heavier raking in the center of the two-track, and an irregular edge to minimize the detectability of the old trail. For a maximum rate of success this should be done early in the active monsoon period. Grass seed should be applied at 12 to 15 lbs. and acre or about .25 lbs. per 100 foot segment of trail. Work should be coordinated with SOAR archeologists to mitigate and avoid any further damage to cultural sites known to exist in this area.

V. Consultations

Dana Backer, Restoration Ecologist at Saguaro National Park, provided technical assistance in designing the grassland restoration treatment.

Danielle Foster, former Chief of Resources Management at Coronado National Memorial (now at Hawaii Volcano National Park), provided review and comment on proposed treatments.

Michele Girard, Ecologist with NPS Southern Arizona Office, provided personal observations and input on many aspects of this assessment.

Perry Grissom, Fire Ecologist at Saguaro National Park, provided information related to past prescribed fire results and other observations.

Andy Hubbard, Network Coordinator for the Sonoran Desert I&M Network, and his staff provided technical assistance in designing the early detection of invasive species treatment, the effectiveness monitoring strategy for the grassland restoration project, and the mapping effort to refine the soil burn severity and vegetation mortality map.

James Leckie, Lead Fire Effects Monitor at Saguaro National park, provided technical assistance in predicting post-fire response of dominant species.

Dean Schilichting, Biologist at Coronado National Memorial, provided personal observations and input on many aspects of this assessment.

Susan Studd, Veg Map Manager for Sonoran Desert I&M, and her staff provided spatial analysis and descriptions of vegetation communities and soil burn severity by veg alliance.

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Monument Fire Facilities Assessment for Coronado National Memorial

Jeremy Curtis

Monument Fire Wildlife Assessment for Coronado National Memorial

Michele Girard, NPS Southern Arizona Office

Objectives:

Assess the impacts of fire suppression actions on Threatened/Endangered/Sensitive (TES) species in Coronado National Memorial (CORO).

Assess the impacts of 'post-fire' habitat on TES species.

Document consultation with US Fish and Wildlife Service

TES Species of Concern:

There are four TES species of concern at CORO:

Lesser long-nosed bat – endangered

Ocelot - endangered

Mexican spotted owl – threatened

Yellow-billed cuckoo – candidate

Lesser Long-nosed Bat

The lesser long-nosed bat (LLNB) occupies a roost in an abandoned mine shaft in CORO. The bats typically arrive in mid-July and depart mid-September. The number of bats has been monitored at the roost for over a decade. Counts range from a few thousand to over 20,000 bats present in the mine at any one time during the roost season. The mine exit has had some form of closure since before occupation by the LLNB. In the past the closure was a cable net, in 2008 different configurations of a bat gates were tested, and in 2010, a semi-permanent gate was installed. There has been ongoing consultation with the US Fish and Wildlife Service concerning the gate as LLNB are not considered to be a species that easily adapts to this type of structure. Following monitoring of the roost in 2010, the FWS determined that NPS had met the terms and conditions of the Biological Opinion. The area in the vicinity of the roost did not burn as the area is covered with mine tailings and there were insufficient fuels to carry the fire.

The number of bats will be counted three times this summer. Additional studies on bat behavior may be conducted this summer. FWS has recommended that the gate remain in place and that all activities in the vicinity of the roost be minimized while the mine is occupied in 2011.

The bats forage throughout the memorial and adjacent lands primarily on agave plants. Three species of agave are known in CORO: Palmer's, Parry's and Shott's. Palmer's is the dominant agave species. There is concern that there is adequate food for the bats in the vicinity of the roost as the fire burned nearly 30,000 acres. Areas west of the memorial remain unburned and this species of bat is known to forage up to 20-25 miles in a night, alleviating some of this concern.

Many agaves have green centers and are expected to survive the fire, however, it is not known if many of the smaller agave 'pups' survived the burn. Pups are vegetative reproduction by agaves and provide age class diversity in the agave populations. Agaves flower only once and die. There is concern that surviving agaves will bolt and therefore reduce the food source for future years. NPS is actively restoring 4500 agave plants in order to mitigate the loss of agave associated with the Department of Homeland Security pedestrian fence. Restored agaves are less than two years old and will not provide a food source for decades.

Suppression Activities: No suppression activities took place in the vicinity of the roost. It is not known, but is doubtful if the LLNB was present during the fire. LLNB were detected the first week of July in the roost which is earlier than usual.

Post-Fire Activities: No rehabilitation activities are planned in the vicinity of the roost. There may be a long-term reduction in the numbers roosting in CORO due to the lack of agave.

Risk: The LLNB may be at an increased risk due to the reduction in agaves as a food source. This risk may be somewhat mitigated as the LLNB are known to routinely fly 20 miles or more per night to forage. Monitoring of the roost is ongoing.

Ocelot

The ocelot had not been recorded in the Huachuca Mountains for several years, until a sighting in the spring of 2011 in the nearby community of Sierra Vista. Although the ocelot is not known to inhabit CORO, this recent sighting has renewed interest in protection of this species and its habitat.

The USFS Monument Fire BAER Wildlife Report states: Ocelots use shrubland, forested and riparian habitats (USFWS 2010). Habitat loss resulted from the fire. Riparian corridors are somewhat intact; however, understory vegetation has been lost. No Critical Habitat is designated for this species as USFWS found it not prudent because such a designation would not be in the best interests of conservation of the species. A reduction in habitat availability within the burned area is expected for several years. Because habitat was lost, individuals may become susceptible to other stressors such as displacement, disturbance, reduced prey abundance, or increased predation.

Suppression Activities: Unknown. It is not known if the ocelot may have been present during suppression activities.

Post-Fire Activities: There are no BAER activities planned to restore ocelot habitat. Hiding cover for the ocelot was lost due to the fire. The plant communities in CORO are expected to recover naturally and no rehab activities are planned.

Risk: The risk to the ocelot following the Monument Fire is predicted as moderate due to the loss of habitat and reduction in prey availability.

Mexican Spotted Owl

There is a Protected Activity Center (PAC) designated for the Mexican spotted owl (MSO) in CORO. The PAC is in a drainage area on a south-facing slope dominated by oak and pine species. Most of the PAC did not burn. No surveys were conducted this year so it is not known if the PAC was occupied. The habitat in CORO is marginal compared to that available on the north-facing slopes on adjacent Forest Service lands. This PAC is not preferred habitat, but has been occupied from time to time. Because this PAC didn't burn with the severity of other PAC's on adjacent FS lands, this remaining habitat becomes even more important. Four PACs on USFS were entirely within the fire perimeter, and six were partially burned.

Suppression Activities: No suppression activities took place within the vicinity of the PAC.

Post-Fire Habitat: It is assumed the MSO and their preferred food source, rodents, survived the fire. However, there could be a reduction in prey due to the loss of habitat. No BAER activities are planned in the vicinity of the PAC.

Risk: Because most of the CORO PAC did not burn, the risk is estimated as low. Due to the loss of habitat on adjacent FS lands, this PAC should be monitored for at least the next three years.

Yellow Billed Cuckoo

The yellow billed cuckoo is a candidate for listing with the US Fish and Wildlife Service. The cuckoo has been sighted in Montezuma Wash. It is not known to nest in the memorial. Most of the riparian and riparian-like vegetation adjacent to Montezuma Wash was not burned. The cuckoo prefers gallery riparian forests, and therefore, habitat in the memorial is considered marginal. Previous surveys have shown sycamore's to be an important component for the cuckoo's foraging roosts in the memorial. The cuckoo's primary food source is invertebrates.

Suppression Activities: No suppression activities took place within the vicinity of Montezuma Wash.

Post-Fire Habitat: Cuckoo habitat is expected to remain stable at CORO as this area did not burn. There were BAER activities that took place in Montezuma Wash that included the removal of hazard trees near the road, clearing of woody debris from the channel, and removal of select trees that interrupted the drainage patterns of the wash. No sycamore trees have been removed. It is possible that work activities disrupted foraging of the cuckoo in this area. There are plans to continue to remove hazard trees and debris in the channel that could disrupt cuckoo foraging.

Risk: The majority of the riparian area along Montezuma Wash did not burn. At this time there has been no direct loss of sycamore trees due to the fire, however, some are scorched and may die in the future. The risk to cuckoo's from the loss of habitat is estimated to be low.

TES Consultation

The US Forest Service, Department of Defense, Bureau of Land Management, and National Park Service conducted emergency phone consultations with US Fish and Wildlife Service throughout the fire. The groups met on June 28, 2011 at the Sierra Vista Ranger District to discuss fire suppression activities that may have impacted T and E species. FWS does not conduct consultation on candidate species. The preliminary determination is that the suppression activities had 'no effect' on threatened and endangered species in the area of the Monument Fire. Several PAC's on USFS lands were consumed in the fire. And there was concern expressed about the long-term loss of the agave food source for the LLNB. The USFS has the lead for preparing the Biological Assessment for the Monument Fire, with input from the other agencies.

Other Wildlife Species

There have been no observations of wildlife mortality as a direct result of the fire on NPS lands. A number of bird species have been observed in the riparian area adjacent to Montezuma Wash. A number of deer have been observed throughout the memorial. Due to monsoon rains, many herbaceous and woody species are already resprouting providing at least a limited food source for herbivores. Since no wildlife mortality was observed, it is assumed that prey species will be abundant for at least the short term immediately following the fire. There may be a long term reduction in the availability of prey due to the loss of habitat. A wildlife camera at one of the memorial's water sources had photographs of mountain lions and at least two different black bears following the fire.

Monument Fire Cultural Assessment for Coronado National Memorial

By Duane C. Hubbard, NPS Archeologist, Southern Arizona Office-Phoenix

Objectives

Protect cultural resources from subsequent post-fire erosion and/or illegal collection, including the park's historic period ranching and mining sites, and numerous Archaic period archeological sites in the lower grasslands.

Issues

Numerous types of cultural resources were threatened during the fire including:

- 1930s CCC Era Public Works (roads and associated features)
- Historic Homesteads (1880-1980)
- Historic Mining Operations (1880-1980)
- Archaic period sites (8500 B.C.- 300 B.C.)

The direct impact from the fire to the historic period ranches and mining sites was reduced by removal of heavy fuel loads in and around sites. Despite this positive observation, the impact to historic period artifacts such as milled lumber, glass and metal is poorly understood.

The condition of Archaic period sites needs to be further evaluated and compared to 2010 baseline information. Numerous illegal border crossing trails bisect sites and contain active and entrenched gully systems that are beginning to expose prehistoric roasting pits. It is unknown at this time how the loss of vegetation cover on these fragile resources will be impacted in conjunction to heavy summer rains.

Future condition assessments at all sites are needed after the summer rains to evaluate the range of impact. Additional condition assessments by NPS archeologists in September 2011, September 2012 and September 2013 will be required to monitor the fire impacts through time.

Observations

Background Information

The Memorial contains a number of prehistoric and historic cultural resources ranging from Archaic hunting camps with potential ages of 8,000 years before present to historic ranches. The Archeological Sites Information Management System (ASMIS) contains 16 sites listed in the national NPS database. Many of these entries are for prehistoric sites that include lithic scatters, mining sites/camps, and ranching homesteads. Although 16 sites are listed in ASMIS, NPS and University of New Mexico archeologists discovered an additional 20 sites (CORO00017.00 – CORO00037.00) in the lower grasslands during a cultural resources border impacts project in FY10 and FY11.

NPS archeologists working at CORO relocated 7 of the park's 16 previously recorded archeological sites on March 16, 2010 and April 26, 2010. The conditions of the sites relocated prior to the fire are listed in the following Table 1.

Table 1: Coronado National Memorial Observed Site Impacts

ASMIS #	Site Impacts	Condition	Severity	Date
CORO00008	No impacts	Good	None	3-16-2010
CORO00009	Sheetwashing, gullyng, vegetation, UDA impacts	Fair	Minor	3-16-2010
CORO00010	Gullyng, arroyo cutting, vegetation , rodent burrowing, UDA impacts	Good	Moderate	3-16-2010
CORO00011	Sheetwashing, gullyng, arroyo cutting, bank slump, vegetation, UDA impacts, human impacts (fire)	Poor	High	3-16-2010
CORO00012	Sheetwashing, gullyng, arroyo cutting, vegetation, UDA impacts, human impacts	Fair	Moderate	3-16-2010
CORO00015	UDA impacts observed during site visit, but no formal condition assessment made	--	--	4-26-2010
CORO00016	Gullyng, arroyo cutting, vegetation impacts, animal burrowing, UDA impacts	Fair	Moderate	3-16-2010
Hilltop Rock Rings	No UDA impacts observed; no formal condition assessment made	--	--	4-26-2010
Masonry Structure	No UDA impacts observed; no formal condition assessment made	--	--	4-26-2010

Reconnaissance Method

Duane Hubbard made two trips from the Horseshoe 2 Fire at CHIR to CORO on June 15 and June 20, 2011 to quickly assess post-burn condition at sites in the grasslands. Hubbard spent June 15th in the field with James Leckie, Lead Fire Effects Monitor at SAGU and serving as the lead READ for the Monument fire. Hubbard and Leckie visited numerous sites including several historic sites with standing masonry. Due to time, and active fire on the hillsides, observations were made but formal post burn condition assessment forms were not completed. Hubbard returned to the sites on June 20th to take several photos and complete further reconnaissance. Condition assessment methods included taking digital photographs and recording general observations about the fire's impact to cultural resources.

Findings

Historic Sites

NPS archeologists recently worked with SAGU fire crews on a planned prescribed burn in the lower grasslands. The prescribed burn was planned for Spring 2011, however, prescription conditions were not met and the fire was postponed. NPS archeologists carried out photographic documentation, condition assessments and heavy fuels reduction around all of the known historic sites in the grasslands. This work included removing brush from structure walls and heavy artifact concentration areas. The work was accomplished in four days with five NPS archeologists and a six-person Student Conservation Association crew. The preparation work proved timely as impacts to historic walls and features were minimized during the fire. The following historic sites received treatment prior to the fire:

CORO00010.00 (cemetery) – Staff used a weedeater to remove tall grass from headstones and graves.

CORO00016.00 – Staff used a weedeater to remove tall grass from walls, removed manzanita and

mesquite from in and around structures.

CORO00028.00 (new site not in ASMIS yet) – Staff used a weedeater to remove tall grass from walls, removed manzanita and mesquite from in and around structures.

CORO00036.00 (new site not in ASMIS yet) – Staff used a weedeater to remove tall grass from walls, removed manzanita and mesquite from in and around structures.

The observed impacts from the fire to historic sites were minor, although the long-term impacts resulting from heavy summer rains and the lack of ground cover is unknown. Also, although some historic artifacts such as glass and metal appeared unaltered, several large historic artifact scatters in the lower grasslands were not visited. Finally, several mines and associated structures located in the upper reaches of Montezuma Canyon were not assessed due to active fire in these areas.

Prehistoric Sites

The following prehistoric sites were burned over during the fire including CORO00008.00, 9, 11, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 29, 30, 31, 32, 33, 34, 37. No fuels reduction was implemented prior to the fire at these sites as the team determined that there would be no benefit to the artifact scatters. Many of the sites contain illegal border crossing trails that have entrenched gully systems. Similar to the concerns for the historic sites, the impact from heavy summer rains and a lack of ground cover could have immediate and long-term impacts to the stability of the sites.

Recommendations

Emergency Stabilization Treatments

Patrolling, camouflaging, burying significant heritage sites listed in this report to prevent looting.

Unlike most other resource categories such as plant communities or wildlife, cultural resources and the significance that they convey is not recoverable once it is lost. Although it's safe to assume that fire has burned through many of the prehistoric sites in the past, the natural fire regime prior to historic periods appears to be more beneficial than adverse as heavy fuel loading was reduced or controlled. Artifacts and features monitored prior to the fire did not illustrate intense burning effects such as potlids on lithics or fire cracked rocks in features other than in roasting pits. Impacts from the fire that could diminish character defining features or aspects of integrity may not appear until subsequent years. For example, slope destabilization on some sites may not happen immediately after the first rains, but can often accelerate through one to five years as rills, gullies and arroyos attempt to find their new baselevel equilibrium that was changed due to alterations in vegetative cover.

In addition to the justification for subsequent condition assessments, further documentation needs were illustrated as the fire revealed unrecorded artifacts, which may extend the current boundaries of sites or cause re-evaluation of how they are defined. Additional mapping and recording of the new site features and size is needed as baseline information to complete condition assessments. For these reasons, it is critical that archeologists monitor and map all of the cultural resources impacted by the fire in the following interval:

Initial post-fire reconnaissance – Completed June 15 and 20, 2011

Post summer rains condition assessment – Scheduled for September 2011

FY12 condition assessment – September 2012

FY13 condition assessment – September 2013

Burned Area Rehabilitation Treatments

N/A

Management (non-specification related)

In addition to the known sites in ASMIS, new sites will be discovered in the future due to loss of vegetation cover. It is unknown at this time how the fire has impacted these sites; however, they will require the same level of documentation, fire damage assessment, and possible treatments. It is not possible to estimate a number of unknown sites at this time due to the ash present throughout the Monument.

Consultations

Jim Bradford, IMR Archeologist, provided technical assistance with proposed treatments

References

Gardner G., K. Converse, J. DeGayner, and D. Hubbard. 2010. Archeological Site Assessment at NPS Park Units Chiricahua, Fort Bowie, and Coronado. Filed at the NPS Southern Arizona Office, Phoenix, AZ. 53 pages.

Monument Fire Public Safety Information Assessment for Coronado National Memorial

By Denise Shultz, Chief of Interpretation, Southeast Arizona Group

I. Objectives

Determine information needs, delivery methods, and costs to provide public safety information concerning hazards and treatments in a post-fire landscape

II. Issues

The entire park is burned over, creating a number of potentially hazardous conditions that will persist for months or even years. Of particular concern is the potential for post-fire flash floods and debris flows in areas heavily used by visitors. Current public information does not adequately convey safety messages relevant to a post-fire landscape.

III. Observations

a. Background Information

- i. Coronado National Memorial (CORO) serves approximately 65,000 visitors per year who utilize over 8 miles of hiking trails. These visitors come from the United States and Canada, as well as from around the world. The Monument Fire burned through the entire park, with several trails receiving high-intensity fire. The vast majority of visitors have little to no experience hiking in a burned landscape. Safety information will need to be available at trailheads, visitor center, and the park's trip planning website to increase their awareness of potential dangers.

b. Reconnaissance Method

- i. Field reconnaissance completed as part of the facilities assessment identified existing information signs that were damaged or destroyed by fire.
- ii. Other locations for information delivery were determined by previous knowledge of trailheads and visitor contact locations.

c. Findings

Visitors and the general public have little knowledge about the ecology, hazards, or effects of fire in the landscape. There are multiple hazards that are potentially dangerous years after the fire has been contained. Education and awareness are critical elements for safety when recreating in a burned landscape. Information about the BAER/BAR team plans, implementation strategy, treatments, and successes helps the public understand the role of fire and the role of land management agencies in the maintenance of a burned landscape. Knowledge often leads to empathy, appreciation, and stewardship.

- i. Inform public about hiking hazards:
 1. Unstable Terrain
 2. Displaced Wildlife
 3. Hazard Trees

4. Burned Stump Holes and Root Chambers
5. Flash Flooding and Debris Flow

ii. Inform public about emergency stabilization and BAR treatment implementations:

1. Stabilize soils
2. Control non-native species
3. Re-establish of native plant communities
4. Re-establish of important elements of wildlife habitat
5. Replace and repair infrastructure damaged by fire.

IV. Recommendations

Redesign and replace bilingual waysides damaged in the fire to incorporate post-fire safety messages. Develop safety information signs for the trailheads where visitors are most likely to hike as well as primary visitor contact locations. These signs would identify major hazards and areas where caution needs to be exercised. Bulletin boards would highlight information updates as conditions change, current treatments, and repairs that occur in the burned areas. For the general public, including non-park visitors, a variety of products would be designed to meet their needs. The park newspaper would be updated with an insert, video/podcasts created to demonstrate the effects of the fire and post-fire changes, photo galleries for the web, and a fire program for an electronic exhibit in the visitor center. Visitor contact staff will need additional training to assist with their interactions with visitors. A staff toolkit would be developed to expand understanding and facilitate the presentation of fire language, hazards, and treatments.

- a. Three bilingual wayside replacements.
- b. Five new safety information signs.
- c. Five bulletin boards. <http://www.whiteboardsetc.com/outdoormessageboards.htm>
- d. Complete compliance necessary for new sign installation (Section 106 and NEPA)
- e. Develop information to be included in on- and off-site publications in both printed and electronic mediums. Provide for printing costs if not covered by Western National Parks Association.
- f. Staff toolkit for visitor contact staff.

V. Consultations

APPENDIX II - ENVIRONMENTAL COMPLIANCE

Federal, State, and Private Lands Environmental Compliance Responsibilities

All projects proposed in the Monument Fire Burned Area Emergency Response Plan that are prescribed, funded, or implemented by Federal agencies on Federal, State, or private lands are subject to compliance with the National Environmental Policy Act (NEPA) in accordance with the guidelines provided by the Council on Environmental Quality (CEQ) Regulations (40 CFR 1500-1508); Department of the Interior and National Park Service. This Appendix documents the burned area emergency response team considerations of NEPA compliance requirements for prescribed emergency stabilization and monitoring actions described in this plan for all jurisdictions affected by the Monument Fire.

Related Plans and Cumulative Impact Analysis

The Coronado National Memorial Fire Burned Area Emergency Response Plan was reviewed and it was determined that actions proposed in the Monument Fire Burned Area Emergency Response Plan within the boundary of the Coronado National Memorial Fire are consistent with the management objectives established in the General Management Plan(2004) and Fire Management Plan (2005).

Cumulative Impact Analysis

Cumulative effects are the environmental impacts resulting from the incremental impacts of a proposed action when added to other past, present, and reasonably foreseeable future actions, both Federal and non-Federal. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time. The emergency stabilization treatments for areas affected by the Monument Fire, as proposed in the Monument Fire Burned Area Emergency Response Plan, do not result in an intensity of impact (i.e. major ground disturbance, etc.) that would cumulatively constitute a significant impact on the quality of the environment. The treatments are consistent with the above jurisdictional management plans and associated environmental compliance documents and categorical exclusions.

Consultations

US Fish and Wildlife Service (Michele Girard, forthcoming)

Arizona State Historic Preservation Officer (Duane Hubbard, forthcoming)

Tribes (Duane Hubbard)

Applicable and Relevant Categorical Exclusions

The individual actions proposed in this plan for Coronado National Memorial are categorically excluded from further environmental analysis as provided for in the Department of the Interior and National Park Service. All applicable and relevant Department and Agency Categorical Exclusions are listed below. Categorical Exclusion decisions were made with consideration given to the results of required emergency consultations completed by the burned area emergency response team and documented below.

#	Treatment or Action	NEPA CE list ¹	Documentation needed? ⁴
ES1	BAER Implementation Leader	NPS 3.3 A personnel actions NPS 3.3 M issue reports	No No
ES2	Refine Watershed Assessment	NPS 3.5 E(5) assessment	Yes
ES3	Install Flood Warning System	N/A – emergency action ²	No
ES4	Storm Patrol	N/A – emergency action ²	No
ES5	Hazard Tree Removal	N/A – emergency action ²	No
ES6	Remove Floatable Debris from Channels	N/A – emergency action ²	No
ES7	Road Clearing and Culvert Cleanout	NPS 3.4 C(4) historic roads NPS 3.4 C(9) maintain road	Yes Yes
ES8	BAER Plan Preparation	NPS 3.3 K issue BAER Plan NPS 3.4 E(5) assessment	No Yes
ES9	Repair Critical Park Infrastructure burned in Site to Restore Safe Operating Conditions	NPS 3.4 C(3) non-historic NPS 3.4 C(4) historic trails NPS 3.4 C(11) trails in general	Yes Yes Yes
ES10	Public Safety Information	NPS 3.3 I distribute info NPS 3.4 C(5) install new signs NPS 3.4 C(8) replace signs	No Yes Yes
BAR1	Early Detection and Eradication of Invasive Plants	NPS 3.4 C(5) weed survey NPS 3.4 C(2) weed treatment	Yes Yes
BAR2	Grassland/Agave Restoration	NPS 3.4 C(2) weed treatment ³ NPS 3.3 X agave planting and grass seeding	Yes No
BAR3	Replace or Repair Minor Infrastructure	NPS 3.4 C(8) replace in kind	Yes

¹ NEPA CE list refers to the National Park Service's Interim Guidance Director's Order 12 Categorical exclusions, which replaced Director's Order 12 Handbook Chapter 3, Sections 3.3, 3.4, and 3.5.

² See Decision Memorandum below regarding these treatments.

³ Suggest further discussion with incoming Chief of Resources Management regarding applicability of this CE for 100 acres of herbicide treatment. If CE is determined to be inappropriate for this scale of treatment, suggest finalizing the draft Environmental Assessment and Invasive Plant Management Plan for Southeast Arizona parks (March 2009 draft from Michele Girard).

⁴ Documentation of this categorical exclusion is required. Suggest putting entire BAER Plan into PEPC and completing the environmental screening form and categorical exclusion documentation.

Decision Memorandum to Support Emergency Stabilization Activities for:

Emergency Stabilization in response to the Monument Fire

U.S. Department of the Interior
National Park Service
Coronado National Memorial
Cochise County, Arizona

Purpose and Need for the Action

The Monument Fire started on June 12, 2011 and burned through the entire 4650 acres of Coronado National Memorial. The fire eventually burned 30,526 acres total before it was contained on July 7th. The entire Memorial was burned over. Burned Area Emergency Rehabilitation Assessments were performed and actions were identified to mitigate potential post-fire watershed impacts on life, property and critical natural and cultural resources. Of particular concern is the potential for impacts to Montezuma Canyon Road and the associated trail system which are vulnerable to flash flooding and debris flows.

Plan Conformance

The proposed actions are consistent with the Memorial's General Management Plan and Fire Management Plan. All proposed actions were designed in conformance with all bureau standards and incorporates appropriate guidelines for specific requires and desired conditions relevant to park resources and public safety.

Compliance with the National Environmental Policy Act

The Proposed Actions are an emergency action not having significant environmental impacts in accordance with 43 CFR 46.150 and 516 DM 2.8.

Decision and Rationale for the Action

I have decided to implement the following emergency stabilization treatments in accordance with 43 CFR 46.150 and 516 DM 2.8:

Treatment or Action

- ES3 Install Flood Warning System
- ES4 Storm Patrol
- ES5 Hazard Tree Removal
- ES6 Remove Floatable Debris from Channels

I considered potential affects public safety, park infrastructure, and on critical natural and cultural resources. The emergency stabilization action is appropriate in this situation because there are no significant impacts and the action is funded as an emergency stabilization project in accordance with 620 DM 3.

Additional emergency stabilization treatments were also identified for implementation under the existing categorical exclusions for the National Park Service in accordance with NPS Directors Order 12, Section 3.

Implementation Date

This project will be implemented on or after July 1, 2011 and the signature on the BAER plan serves as the approval signature for this memorandum.

Administrative Review or Appeal Opportunities

This decision is not subject to administrative appeal.

Contact Person

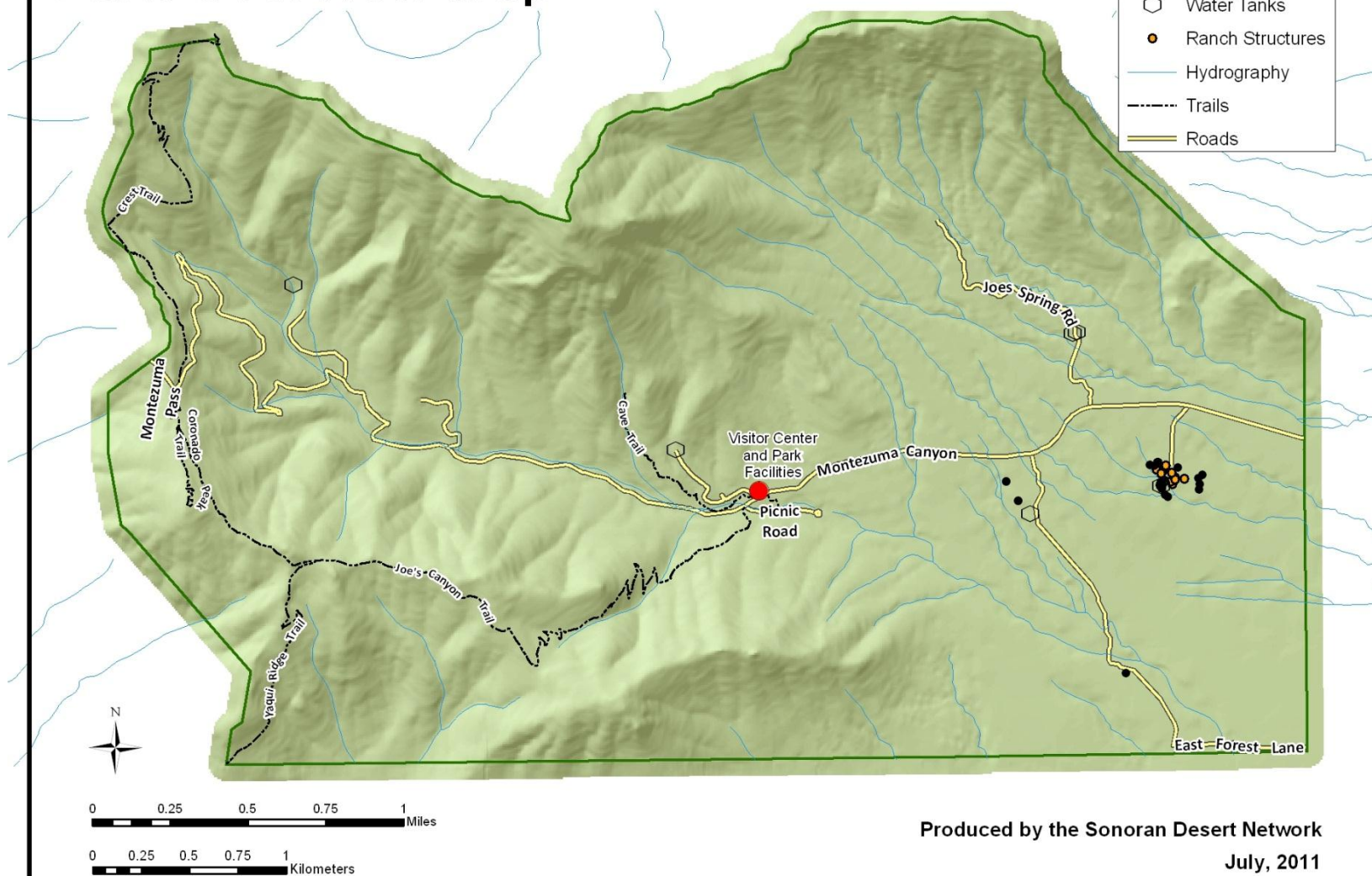
Office of the Superintendent
520-366-5515 x 2101

APPENDIX III - MAPS

- Park Overview
- Fire Perimeter
- Draft Soil Burn Severity
- Road Drainage
- Vegetation Treatments

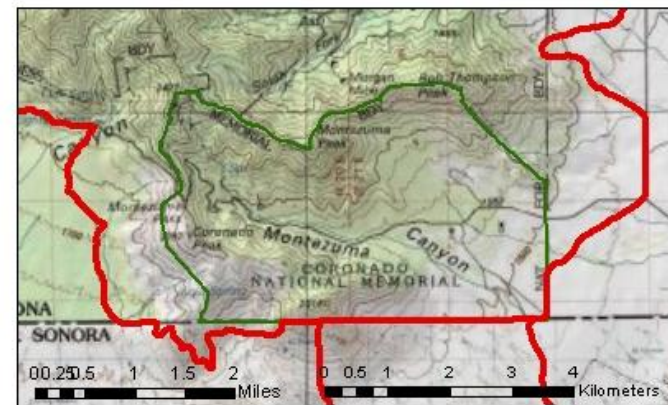
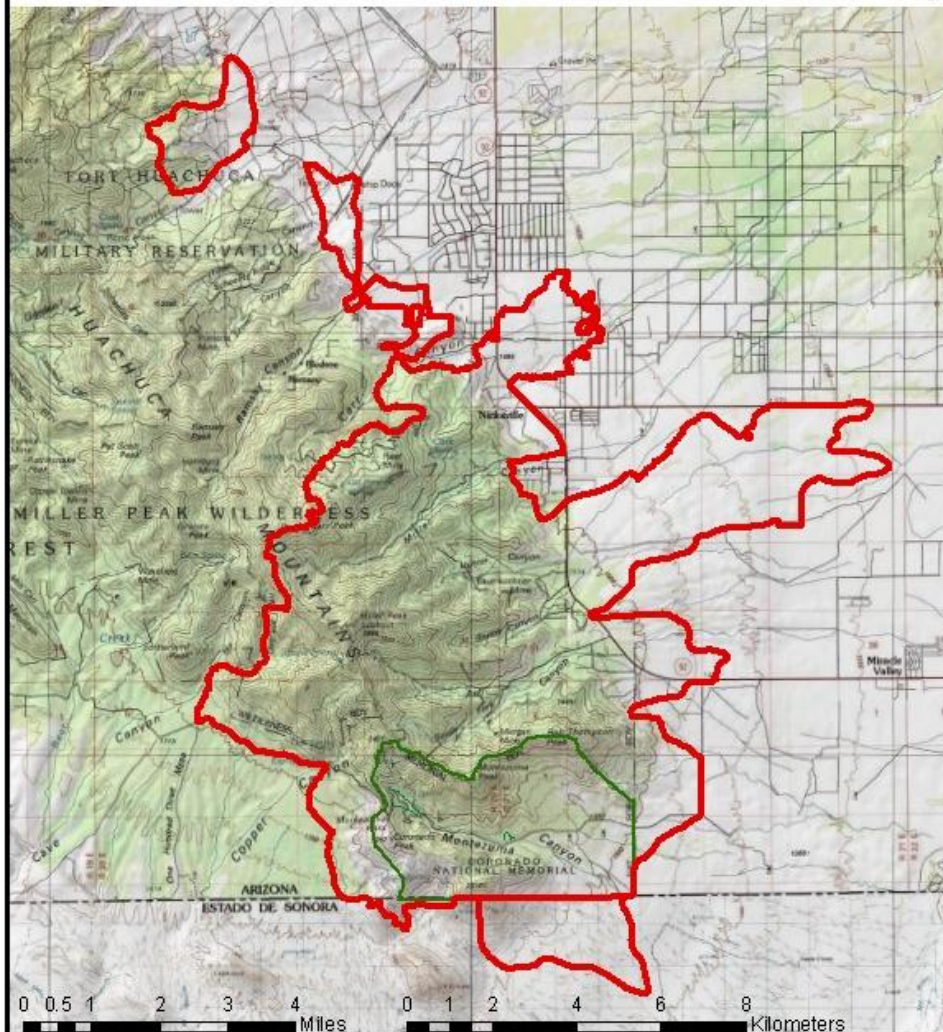


Park Overview Map





Monument Fire Perimeter June 26th, 2011



Inset: Coronado detail

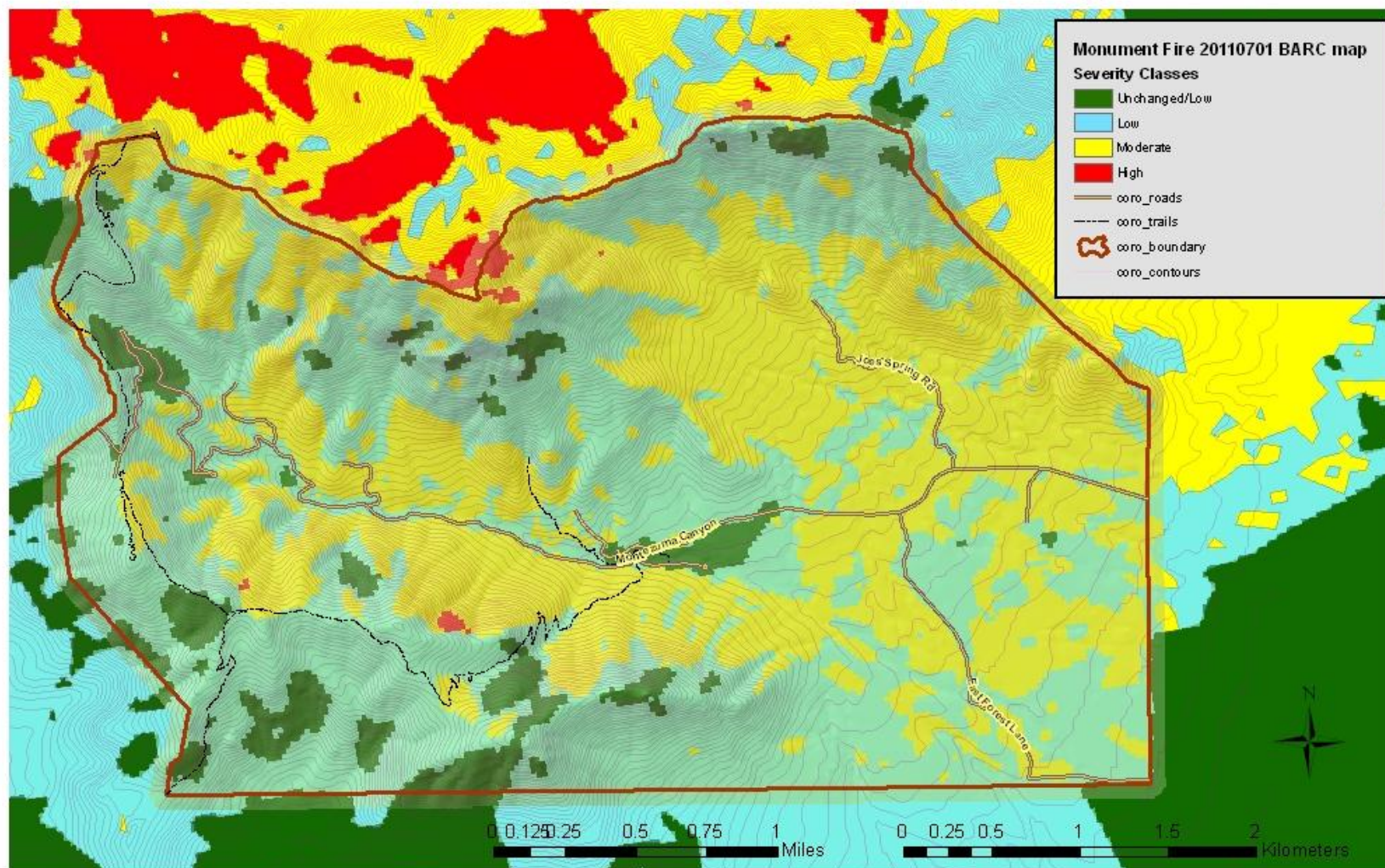
Legend

- Monument Fire Perimeter
- coro_boundary



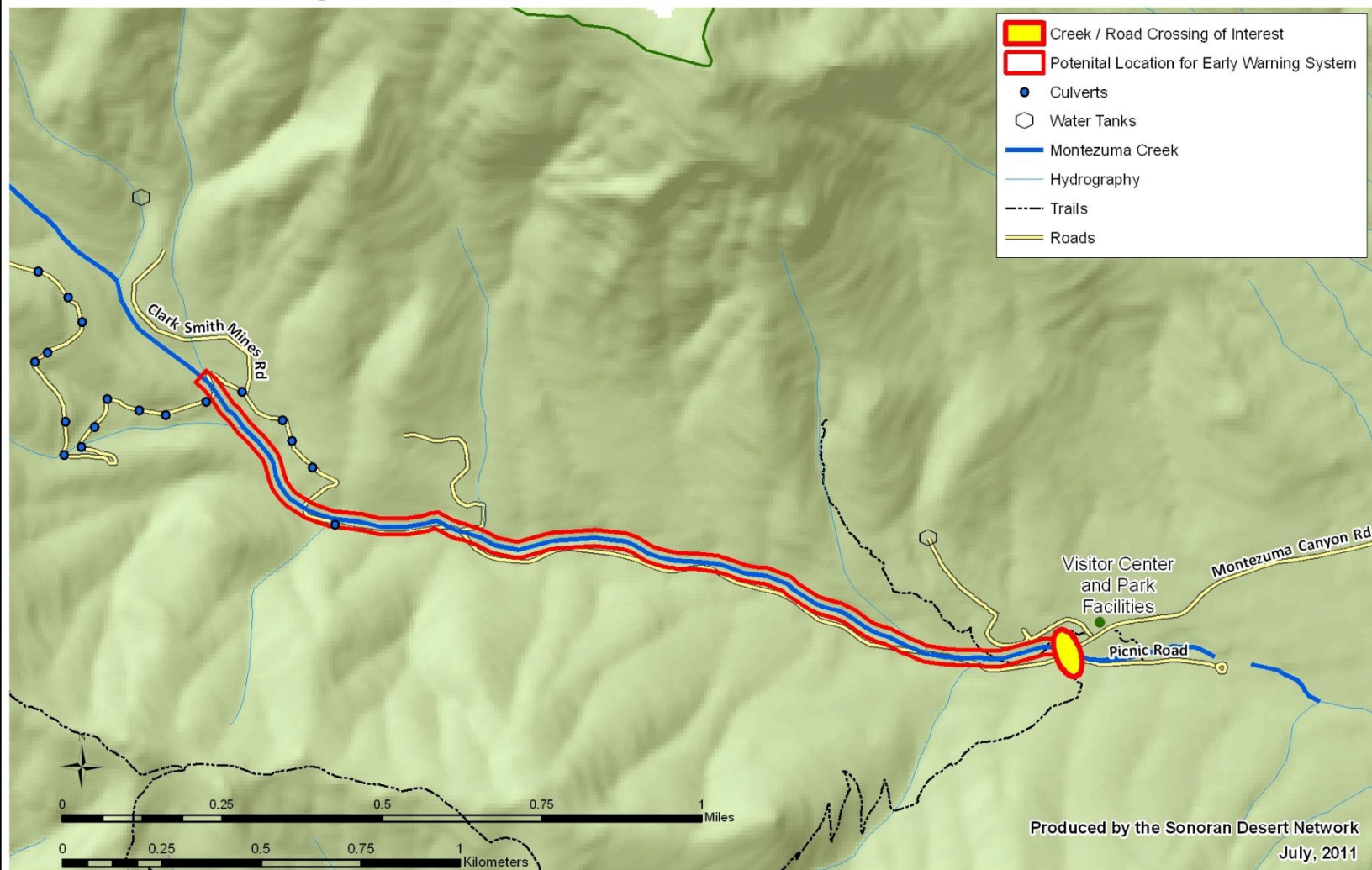


Burned Area Reflectance Classification Map - Original



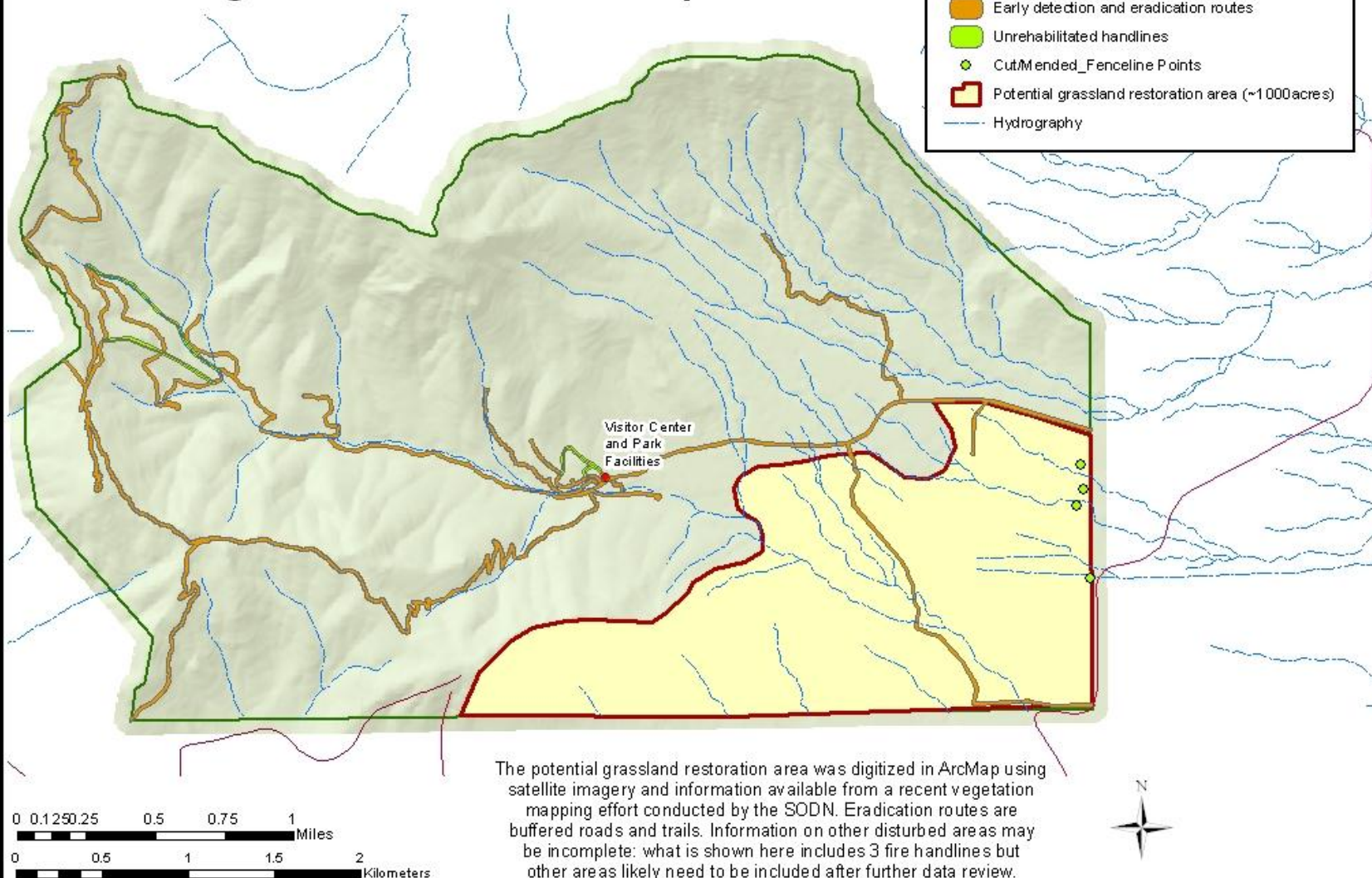


Road Drainage Report





CORO Vegetation Treatment Map



APPENDIX IV – SUPPORTING DOCUMENTATION

- Initial BAER Request
- Flood warning system details
- Example Standard Operating Procedure for Outplanting

Monument Fire Burned Area Emergency Rehab Initial Request

6/18/11

DRAFT mgirard

The Monument Fire was reported at 1 pm on June 12, 2011 burning in Coronado National Memorial (CORO). Air support was requested immediately but the fire spread quickly due to extreme fire conditions: high winds, low humidity, high temperatures, and low fuel moisture. The fire quickly spread to national forest and private lands. CORO and Coronado National Forest (CNF) share jurisdiction. The fire is within the Huachuca Mountains and associated valley bottoms south of Sierra Vista in southern Arizona.

At the time of this initial request, 30,000 acres have burned, 4750 on NPS lands or more than 90% of the memorial. Additionally, more than 50 homes were burned.

BACKGROUND

Coronado National Memorial is in the Huachuca Mountains in southern Arizona. The mountains are geologically unstable and subject to debris flows and instability. The area has a bi-modal distribution of precipitation. The summer monsoon season typically begins to set-up in late June and early July. Storms are often of short duration and high intensity, leading to frequent flooding events and soil/unconsolidated material movement. Dry lightning is common during this time. Winter rains come in late November through early March, and tend to be slow moving, less intense precipitation events. However, winter storms have triggered flooding but much less frequently than monsoon storms.

The memorial experienced severe flooding in 2006 when approximately 8.5" of rain fell within a 24 hour period (1000 year event). This storm triggered 21 debris flows and severe flooding throughout the memorial. Fifteen of the debris flows crossed the Montezuma Pass Road. All of the drainage structures along the road were impacted. There was another flood in 2008 when a 50 year event occurred on a portion of the watershed (Smuggler's Ridge) and triggered flooding in Montezuma Wash near the Visitor Center (50 year event). The flood waters carved a new channel that jumped the road and threatened the integrity of the CCC headwall structure built around two 8' culverts. The lower 1200' of the channel was restored to its previous meander in the summer of 2010 and designed to withstand a 25 year event. The Montezuma Pass Road serves as the only vehicular access across the southern Huachuca Mountains to access the memorial, national forest lands and private properties. The road is critical to the mission of the US Border Patrol to provide for homeland security in their efforts to interdict drugs and illegal aliens.

More than 90% of this inherently unstable watershed burned. We anticipate issues with flash flooding, road drainage problems, soil erosion, and debris movement.

Burned Area Emergency Objectives

The Monument Fire Burned Area Emergency Response (BAER) Team and READ's assigned to the fire assessed the incident to determine post-fire impacts to life, property, and critical and natural resources. The team conducted field visits to review resource conditions after the fire, completed literature reviews,

and consulted resource specialists. The main objectives of the field visits were as follows:

- Develop soil burn severity and watershed response maps to identify potential
- flood and erosion source areas
- Identify and inventory values at risk
- Identify the physical and biological mechanisms that are creating risks
- Review channel morphology and riparian conditions
- Inspect hill slope conditions
- Determine needs for emergency stabilization

PRELIMINARY ASSESSMENT

NPS staff with the assistance of Resource Advisors drafted this preliminary assessment.

- Dave Marr, soil scientist for USGS Helena National Forest. Dave has previous BAER and READ experience.
- James Leckie, Lead Fire Assessment Tech, Saguaro National Park. James has extensive READ, fuels, and burned assessment experience. And has done fuels plots in CORO.
- Michele Girard, ecologist, NPS Southern Arizona Office. Michele has previous BAER experience and is familiar with the resources of CORO.
- Jeremy Curtis, Chief of Maintenance, SEAZ
- Duane Hubbard, Archeologist, SOAR

Please note that this is a very preliminary assessment to identify some of the obvious values at risk such as road issues, hazard trees, and cultural resources for this initial submission. A full BAER team assessment is planned for the near future and the results of their assessment, particularly for hydrology, soils and facilities will be added. Cultural resource surveys are ongoing and an assessment of facilities is scheduled for 6/26.

ADDITIONAL ASSESSMENTS NEEDED

Burn Severity

The Resource Advisors mapped the burn severity in the memorial. They found that most of the park burned with moderate severity. They found no hydrophobic soils, and attributed this to the lack of organic matter in the soil. The infiltration rate may not change that much because of the amount of rock and lack of organic matter. The preliminary map needs to be compared to the BARC. *Report to be added later.*

Soils

Dave has a report drafted; I just didn't get it yet.

Hydrology

There is a need for a hydrologist to assess the memorial and make treatment recommendations. The preliminary assessments by the READ's and NPS staff indicate additional work is needed, particularly on the following areas:

1. Hydrologic Modeling. No models have been run to assess changes in the watershed due to the fire.

2. Channel Clearing. The headwaters of Montezuma Canyon were assessed for the presence of large woody debris that could exacerbate flooding conditions in the channel and on the road. READ's found hand line had been constructed along the channel from the 6200 low water crossing down to the Warren Crossing. The READ's are working with suppression crews to rehab this reach. The Warren Crossing down to the First Crossing was also assessed and we took several photos. There is some woody debris, but it is not excessive. Clearing of this reach should be discussed with a hydrologist before this treatment is recommended. The First Crossing down to the Visitor Center has not been assessed.
3. Montezuma Pass Road. An assessment of the road and drainage by a hydrologist is needed. READ's expressed concern about the number of tributaries (that all served as debris flows in 2006) that converge on the road between the Warren and 6200 Crossings. There is historic CCC drainage rock work in this steep portion of the road and watershed and the current drainage configuration may not be adequate.
4. Montezuma Canyon. The reach of Montezuma Canyon restored in 2010 should be assessed. It was designed to withstand a 25 year flood event in an unburned watershed. Due to the drought, there has been little flow in the channel since the restoration project. The area of the channel that breached in 2008 appears to be at risk of breaching again in high flows.
5. There is a set of two culverts on the entrance road that need to be inspected because the channel material above the culverts is higher than the road, or at least it looks that way.

Road Engineer

The services of a road engineer are requested. The road is inherently unstable and severe issues with drainage are anticipated. The culverts frequently plug following precipitation events. Retired Facilities Manager, Henry Ruiz, feels the historic culverts are too small and should be replaced. He felt they should have been replaced after the 1988 event. Therefore, we need the expertise of an experienced road engineer.

Geomorphology

Due to the inherently unstable geology of the Huachuca Mountains and the instabilities resulting from the 2006 debris flows an assessment is needed by a geomorphologist to determine potential impacts to the Montezuma Pass Road and any potential hazards to human health and safety.

(NOTE: Ann Youberg and Phil Pearthree of the Arizona Geologic Survey have been assessing stability and debris flow issues in the Sky Islands of southern Arizona, and their input would be valuable in finalizing treatments. Ann has been recruited by Bob Lefevre for the Horseshoe 2 BAER team. Phil has indicated he is willing to help. The issue is how to pay them; the state is currently paying Ann. Bob is coordinating their assistance and Michele will work with Bob to see if we can get them to CORO.)

Cultural Resources

Very preliminary cultural resource surveys have been initiated, but more assessment remains to be done. There are a number of pre-historic and historic sites in the grasslands that need to be assessed for any damage related to the fire, and to determine if any stabilization treatments are needed.

(NOTE: Duane Hubbard of the NPS Southern Arizona office is familiar with these resources and has

begun cursory assessments. Michele will continue to work with him.)

Natural Resources

The fire burned with low to moderate severity and mimicked a prescribed burn throughout much of the memorial. Areas of high burn severity need to be assessed in greater detail to determine if additional treatments are necessary.

Bats: The Huachuca Mountains provide important habitat for the endangered lesser long-nosed bat. There are important roosts for the bat at CORO, and on adjacent US Forest Service and Department of Defense lands – some of which have/will also burn as part of the Monument Fire (check with FWS). The bat roosts in caves and mines. The roost at CORO has been assessed and was not affected by the fire. However, much of their primary food source, agaves, has been lost. CORO has been working in cooperation with the US Fish and Wildlife Service (FWS) and the Department of Homeland Security (DHS) to mitigate the loss of several hundred agave plants lost due to the construction of the DHS pedestrian fence. The restoration plot was burned and the remaining agave plants are severely stressed from the ongoing drought, unusually cold winter temperatures, and desiccation from the fire. Mitigation of the loss of agaves is a requirement of the Biological Opinion rendered by FWS. NPS, DHS and FWS will invest close to \$500,000 for agave restoration on this site and protection of this investment is important to meet the terms and conditions of the BO and provide a future food source for the endangered bat.

The loss of agaves throughout the memorial poses a risk to the endangered lesser long-nosed bat and consultation with FWS is ongoing. We were able to water the remaining agaves on 6/21/11.

Invasive Plant Species: Invasive plant species are of serious concern at CORO due to the dominance of Lehmann lovegrass in the grassland areas of the memorial. The fire created conditions favorable to the spread of this species into other areas of the memorial. Fire suppression actions also created conditions favorable for its spread. Additional invasive species may have inadvertently been introduced by suppression activities.

VALUES AT RISK

Human Health and Safety

Flooding: The memorial is subject to flash flooding. There have been two recent severe flooding events in 2006 and 2008 where the road was impassable. It is important to conduct storm patrols and erect flood warning signs on the road at each park entrance. Additional signs warning of flash floods and hazardous conditions should be posted along trails. *Estimated costs: Storm patrols \$1000 each x 4 = \$4000, Road Signs \$350 x 2 = \$700*

Hazard Tree Removal: Some hazard trees have been removed by suppression to ensure safety for ongoing activities. An assessment of hazard trees in the vicinity of admin buildings, picnic ground, roads and trails needs to be conducted. *Estimated costs: ?*

Infrastructure

At this time, there has been no systematic assessment of infrastructure in the memorial. These estimates are based on cursory observations and some cost estimates from CHIR. A complete assessment and treatment recommendations needs to be conducted by qualified personnel.

Montezuma Pass Road

The primary value at risk is the Montezuma Pass Road and its associated historic significance. The road drainage dates back to the Civilian Conservation Corp and the entire road has been designated on the National Register of Historic Properties. As with many mountainous areas, Montezuma Pass Road and Montezuma Canyon are both trying to occupy the same space in a geologically unstable area, leading to issues of stability and frequent flooding.

Channel Clearing: Woody debris needs to be removed from one mile of the Montezuma Canyon channel between the Warren Low Water Crossing and the visitor center prior to the onset of the monsoon season. A class A or B sawyer is sufficient. (CHIR estimates = 1 sawyer + 1 swamper = \$1500/mile) *Estimated Cost: 1 mile x \$1500*

Road Grading: High traffic from heavy equipment created issues with the gravel surface of the road. The road needs to be graded and maintained. Suppression may cover this cost, if not it will be submitted through BAER. Using NPS grader: \$2000 operator, \$1200 water tender, 750 tons AB @ \$15 = \$11,250 *Estimated cost: \$14,450*

Culverts: There are approximately 76 culverts on the Montezuma Pass Road that need to be inspected and cleaned. Many are listed cultural sites and care needs to be taken in their maintenance. Cost per cleaning is \$3000. We originally estimated 4 cleanings would be needed. However, I have been talking with Henry Ruiz, former Chief of Maintenance, and he said following the 1988 fire he had a crew on for one year to continually clean the culverts. The 1988 fire burned 80% of memorial and he says it crowned out and was of higher intensity than the Monument Fire. Henry feels Cost is \$3000 per cleaning.

Estimated Cost: \$3000 x ????

Infrastructure

Trails: There are approximately 12 miles of trails. Many of the trails are in areas of inherent instability and some within the area of high burn severity. We have not completed an assessment of all of the trails.

- Joe's Canyon – This trail is approximately 3 miles in length. The trail needs to be cleared of debris and hazard trees, and the drainage needs to be maintained. Work requires a class a or b faller and a swamper. Several wooden drainage structures burned and need to be replaced. The trail was maintained in 2008 and the cost at that time was \$45,000.
Estimated cost: \$45,000+ inflation factor
- Crest Trail – Crest is 1 ½ miles in length. There are two 50' wooden retaining walls that need to be inspected, as well as trail maintenance similar to Joe's Canyon. The costs for trail maintenance are shown, however, additional funding may be needed if the walls are damaged.
Estimated cost: 1 1/2 miles x \$1500 = \$2250
- Grassland Trail – 1 ½ miles. Brush out engine tracks, seed specific areas, check the drainage, remove debris.
Estimated cost: \$1500.
- Picnic Trail – This trail did not sustain damage.
- Cave Trail – 1 mile. See Joe's canyon. 1 x \$1500 = \$1500.

- Peak Trail – ½ mile. ½ x \$1500 = \$750
- Flash flood warning signs at each trail head and picnic area. Estimate 7 signs needed @ \$100 each.
Estimated Cost: \$700

Fence:

- Sections of the eastern portion of barbed wire boundary fence burned and some sections cut to allow the entry of suppression equipment. Approximately 1 mile of fence needs to be repaired or replaced at a cost of \$5000/mile.
Estimated cost: 1 mile at \$5000
- Approximately 170' of the wood rail fence at the Pass was charred, and 48' is in need of repair. Estimated cost: materials \$250 materials + \$1350 labor = \$1600
- Additional wood fence on both sides of the entrance to the memorial burned and needs replacement – approximately 30'. \$150 material + \$1450 labor of = 1600
Estimated cost: \$1600
- Visitor Center fence – approximately 200 feet of split rail fence needs to be replaces.
Estimated Cost: \$6500

Signs - replacement

- Trail signs –At this time we know there are five trail directional signs that need to be replaced. 5 x \$200 each.
Estimated cost: \$1000
- Three interpretive signs were burned at a cost of estimated \$1000/sign.
Estimated Cost: \$3000
- Trail Benches – There are two benches along the Coronado Peak Trail that burned. The benches are constructed of wooden slats anchored to metal pipe that is set into rock structures. The high cost is due to the slats needing to be replaced by hand. Materials \$200 + labor \$1300 for both.
Estimated Cost: \$1500
- One picnic table burned.
Estimated Cost: \$1300
- The contact station sustained smoke damage and portions need to be repainted. Material \$50 + \$500 labor
Estimated Cost: \$550
- Park administrative buildings need to be cleaned of dust and smoke from the fire. Labor from park staff \$2400.
Estimated Cost: \$2400

Cultural Resources

Montezuma Pass Road: The Montezuma Pass Road has been designated on the National Register. It is important to protect the historic drainage structures along the road. Several pre-historic sites exist in the grasslands. Some have issues of stability due to illegal traffic.

Grassland Site: One site in the grasslands has been identified as being in need of treatment and

additional assessments are needed on other sites. There is active erosion in this area which will be exacerbated by the fire. Preliminary treatment recommendations are to place brush in the headcut areas and to seed the site. A complete report will be completed detailing treatment needs and a qualified archeologist will be on-site prior to treatment implementation. *Estimated cost: \$2000 (total swag from CHIR numbers)*

Natural Resources

Invasive Species: Burned areas should be monitored and treated to prevent the introduction and spread of these species. *Estimated cost: GS5 x 3 months = \$8000*

TREATMENTS

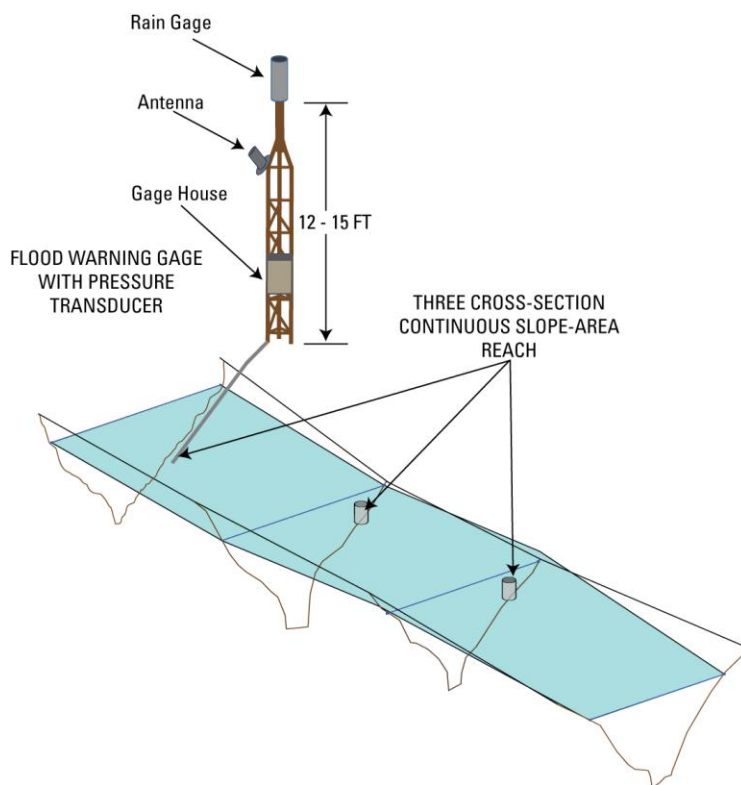
Area	Treatment	Costs
CORO	Storm patrols	\$4,000
Road entrances	Flash floods warning signs	700
Trail System	Flash floods warning signs	700
Trail system	Sign replacement	1,000
CORO	Hazard tree removal	
Road/channel	Channel Clearing	1,500? done
Road	Grading	Costs
Road	Culvert Cleaning	Under estimated 12,000?
Trails	Clearing and drainage	Jeremy 51,000
Boundary	Fence repair/replacement	
Entrance, VC and Pass	Wood fence repair	14,700
CORO	Sign replacement interp x 3 denise	1200
Grasslands	Cultural site treatment ?? duane	2,000
CORO	Invasive species monitoring & treatment – next year	8,000
repeater		
VERY PRELIMINARY TOTALS		\$119,100

Flood Warning System

Information provided by Chris Smith, US Geological Survey, Tucson, AZ

A flood warning gage is proposed to be constructed to measure the stage in a river during flow events. The flood warning gage consists of a tower about 12 to 15 feet in height. Precipitation is measured with a rain gage installed on the top of the tower. Stage of the channel will be measured with a pressure transducer installed inside a small metal conduit. A data collection platform (DCP) will be installed in a small gage house to DCP will store and transmit all of the collected stage and precipitation data. Two additional pressure transducers will be installed at the flood warning gage to measure the water-surface elevation during a runoff event. The water-surface elevations from each of the three pressure transducers can be used to indirectly calculate discharge using the Continuous Slope-Area method (Smith and others, 2010). The Continuous Slope-Area (CSA) method allows for the development of continuous discharge hydrographs and rating curves.

The rainfall, stage, and streamflow data will be available on our public Web page NWIS-Web at <http://waterdata.usgs.gov/az/nwis/current/?type=flow>. This will allow the public to view the data and to use WaterALERT at <http://water.usgs.gov/wateralert/> to send flood data to their phone or computer when a threshold is exceed by a storm event. All USGS streamflow and precipitation data is sent to the National Weather Service to be used to issue flood warnings.



Smith, C.F., Cordova, J.T., and Wiele, S.M., 2010, The continuous slope-area method for computing event hydrographs: U.S. Geological Survey Scientific Investigations Report 2010–5241, 37 p., available online at <http://pubs.usgs.gov/sir/2010/5241/sir2010-5241.pdf>

Example SOP for outplanting using Dri-water and CritterOut

Lake Mead NRA
Standard Operating Procedure:
Planting/Dri-Water

Read how to transplant plants in desert environments on pages 24-30 in *A Beginner's Guide to Desert Restoration* Second edition copyright 1998.

At LAME we have experimented and used Dri-Water when transplanting plants in a restoration site. Using Dri-Water frees up the crews time and energy from hand watering the sites, especially in the summer. Dri-Water is a gelatinous compound that releases moisture into the ground roughly over a 3-month period of time. We plant these tubes and gel while we are transplanting each plant. The hole for the gel should be next to the plant but not on top of it. As long as it is near the surrounding soil but not directly touching the roots it will be fine. Make sure you have the right depth. You only want the cap to be exposed and easily obtainable. Place a heavy rock on the cap because it will blow away and dry out in these high desert winds and sun. During the summer we check the Dri-Water gel every month.

During the winter months we do this every 2 months. Gel is replaced as needed for the first year or first 2 summers. Then the devices are removed. Plant mortality is documented after one, three, six and twelve months, then every year thereafter for five years. Photos are taken at the same time from the established. Once the plants have grown to a decent height and Alice approves, remove the tubes. You can kick the top of the tubes to loosen them from the soil. They will pull out quite easily. Make sure to backfill the holes really well.

Consumable Supplies:

- plant material
- pre-made cages
- 11 gauge staples
- Dri-Water tubes and gel
- gas & oil for auger

PPE:

- safety glasses
- ear protection
- gloves

Restoration Crew Equipment:

- auger
- shovels, trowels
- utility knife

On Site Material:

- rocks

Plant Installation

Auger a hole 1 foot deep (you may need to go deeper depending on what you're transplanting).

If water is available, water the hole.

Gently tap the plant out of the pot. Be sure not to damage the roots. Place the plant in the hole.

Place the Dri-Water tube on an angle near the roots, but touching them. The top of the tube will be level with the top of the soil.

Open one end of the Dri-Water gel with a utility knife. Place the open end facing down in the tube. Cover with lid.

Cover roots and tube with soil. The soil level should be about the same as the soil level was when it was

in its pot.

Water plant. Do not make a water basin.

Cover lid with a rock.

Place cage over plant. You can weigh down the edges of the cage with rocks or 11 gauge staples.

Planting Maintenance

The plants need to be cared for once a month during the summer, and every three months in the winter. The first thing you may want to do is check the condition of all the plants and make sure the Dri-Water tubes are in their proper position with lids in place. Count the numbers for each species of plant that have died and record them on the plant survival sheets (one sheet per island and perimeter). Refill the Dri-Water tubes, the installation instructions are below the Critter Out™ instructions on page two of the Planting SOP. At some locations the plants will be contained within protective wire cages which some visitors like to use as garbage cans. Please properly dispose of the trash and straighten up the cages as necessary. Plants without protective wire cages require the application of Critter Out™ pest repellent, once a month, in order to prevent animal disturbances to the plants, Dri-Water tubes, and gel packs. The repellent is in concentrate and must be diluted into a 10:1 ratio, then applied with a backpack sprayer to completely cover all surfaces of the plant and Dri-Water tube.

Critter Out™ directions are as follows:

Shake well

Mix 12.8 oz of concentrate with 115 oz of water to make 1 gallon (128 oz) of ready mix (10 to 1 ratio).

Spray heavily, directly on and around the area you want to protect.

Repeat process every 7 days or as needed (we repeat every 30 days).

During periods of heavy rain, or areas of intense animal pressure, more frequent applications may be necessary.

Store in a cool dark area out of the sun.

Additional information about these products is available at:

<http://www.greenislanddistributors.com/product/Critter-Out.htm>

<http://www.driwater.com/>