**File Code:** 2520-3/6520 **Date:** July 25, 2000
**Route To:**

**Subject:** Burned Area Emergency Rehabilitation – Bobcat Fire, Interim Request

**To:** Chief

Please find attached an interim request for additional Burn Area Emergency Rehabilitation funding for the Bobcat Fire on the Arapaho and Roosevelt National Forests. Based on more accurate site surveys, treatment designs and updated treatment costs, additional funding is necessary to complete the project.

The following major work has been completed as of July 24, 2000:

* 375 acres of contour-felled logs
* 5 acres of straw wattles
* 115 acres of mulch
* 810 acres of seed
* 15 miles of drainage improvements on roads
* Hazard tree survey/removal along roads and trails within burn perimeter.
* Installation of two rain gages linked to an emergency warning system.

The table below reflects the approved and updated cost estimates for the project:

| | Approved Request (6/30/00) | Updated Request (7/24/00) | Additional Funds Requested (7/24/00) |
|---|---|---|---|
| Land Treatments | $561,000 | $641,000 | $80,000 |
| Roads and Trails | $134,000 | $134,000 | $ 0 |
| Public Information | $ 19,000 | $ 19,000 | $ 0 |
| Administration | $ 24,000 | $124,000 | $100,000 |
| Monitoring Plan | $ 48,000 | $ 48,000 | $ 0 |
| Total: | $786,000 | $966,000 | $180,000 |

Differences in cost estimates are mainly the result of updated costs per unit acre for aerial seeding, additional acreage for contour-felled log treatments and staffing of an Incident

Command System to oversee timely and effective implementation of treatments. An additional $180,000 is requested and estimated to cover these costs.

Sincerely,

/s/ DeAnn Zwight for

LYLE LAVERTY
Regional Forester

Cc: Jerry Freeouf, R.O. BAER Coordinator
Tim Sullivan, R.O. BAER Coordinator
Dave Gloss, ARNF, Bobcat BAER Team Leader

Enclosure: Burned-Area Report – Interim (7/24/00).

USDA Forest Service FS-2500-8 (8/93)

Date of Report: July 24, 2000

# BURNED-AREA REPORT

(Reference FSH 2509.13)

## PART I - TYPE OF REQUEST

**A. Type of Report**

[XX ] 1. Funding Request for Estimated WFSU-SULT Funds

[ ] 2. Accomplishment Report

[ ] 3. No Treatment Recommendation

**B. Type of Action**

[ ] 1. Initial Request (Best estimate of funds needed to complete eligible rehabilitation measures)

[XX ] 2. Interim Report
[X ] Updating the initial funding request based on more accurate site data and design analysis
[ ] Status of accomplishments to date

[ ] 3. Final report-following completion of work

## PART II - BURNED-AREA DESCRIPTION

**A. Fire Name:** Bobcat

**B. Fire Number:** P23777

**C. State:** Colorado

**D. County:** Larimer

**E. Region:** 2

**F. Forest:** Arapaho and Roosevelt

**G. District:** Canyon Lakes

**H. Date Fire Started:** 6/12/00

**I. Date Fire Controlled:** 6/24/00

**J. Suppression Cost:** $3.59 million

**K. Fire Suppression Damages Repaired with WFSU-PF1 2 Funds:**

1. Fireline waterbarred (miles): 9.5
2. Fireline seeded (miles) 1.0
3. Other (identify) Suppression guidelines provided upon request.

**L. Watershed Number:** 101900060410, 101900060802, 101900060618

**M. NFS Acres Burned:** 7,295 Private Acres Burned: 3,304 Total Acres Burned: 10,599

**N. Vegetation Types:** Ponderosa Pine (66%), Douglas-Fir (16%), Lodgepole (9%), Grass/Shrub (8%), Aspen (<1).

**0. Dominant Soils:** Depths are mostly shallow and moderately deep. Particle size classes are mostly loamy-skeletal with some loamy. Mineralogy classes are mostly paramicaceous with some mixed. Dominant parent materials are slope alluvium and colluvium over residuum derived from gneiss, schist, and micaceous granite. Dominant temperature regime is frigid with some cryic on north slopes. Dominant subgroups are Lithic Haplustepts, Lithic Haplustalfs, and Typic Haplustepts and Typic Haplustolls. Steep slopes and high mica content make these soils highly erosive.

**P. Geologic Types:** Mostly Precambrian gneiss and schist with some Precambrian intrusive micaceous granite on Green Ridge.

**Q. Miles of Stream Channels by Order or Class (includes crenulated/extended network):**

| | | | | | |
|---|---|---|---|---|---|
| 1st: 46 | 2nd: 17 | 3rd: 12 | 4th: 2 | 5th: 0 | Total: 77 |

**R. Transportation System (miles in burn perimeter):**

| | Trails | Roads | Total |
|---|---|---|---|
| **NFS** | 2.4 | 19 | 21.4 |
| **PVT** | 2.2 | 13 | 15.2 |
| **TOTAL** | 4.6 | 32 | 36.6 |

## PART III - WATERSHED CONDITION

**A. Fire Intensity (acres):**

| | Low | Moderate | High | Total |
|---|---|---|---|---|
| **NFS** | 2377 | 1758 | 3159 | 7294 |
| **PVT** | 810 | 885 | 1610 | 3305 |
| **TOTAL** | 3187 | 2643 | 4769 | 10599 |

**B. Water-Repellent Soil (acres):**

NFS: 3159 acres PVT 1610 acres TOTAL: 4769 acres

**C. Soil Erosion Hazard Rating (acres):**

| | Low | Moderate | High | Total |
|---|---|---|---|---|
| **NFS** | 218 | 3966 | 3104 | 7288 |
| **PVT** | 213 | 1923 | 1175 | 3311 |
| **TOTAL** | 431 | 5889 | 4279 | 10599 |

**D. Erosion Potential:** 54 tons/acre

**E. Sediment Potential:** 8958 cubic yards/square mile (14 cubic yards/acre)

## PART IV - HYDROLOGIC DESIGN FACTORS

**A. Estimated Vegetative Recovery Period:** 2-3 years (based on nearby Crosier Mtn and Snowtop high intensity fire areas vegetative recovery with no treatment).

**B. Design Chance of Success:** 80 percent

**C. Equivalent Design Recurrence Interval:** 10 years

**D. Design Storm Duration:** 24 hours

**E. Design Storm Magnitude:** 3.0 inches

**F. Design Flow:** 105 cubic feet per second per square mile

**G. Estimated Reduction in Infiltration:** 45 percent

**H. Adjusted Design Flow:** 274 cubic feet per second per square mile

## PART V - SUMMARY OF ANALYSIS

**A. Describe Watershed Emergency:**

The Bobcat fire is several times larger than any recorded fires on the Forest. Almost half of the fire burned in an intense, fast moving crown fire through ponderosa pine/Douglas-fir forest. Large blocks of intensely burned area are interspersed with areas that burned with low to moderate intensity. The fire severity (effects to soils) is high to moderate for the majority of these high intensity burned areas (45%). Fire severity is low in other burn intensity areas (55%). Hydrophobic (water repellent) soil conditions exist at the mineral soil surface throughout most of the high intensity burn areas. This surface hydrophobic layer is thin, which suggests it will break down more rapidly than deeper and thicker hydrophobic layers. Until infiltration rates recover in the water repellent surface layer a significant risk exists for increased runoff, erosion and flooding. A single rainfall simulation plot (application rate of 3.5 inches per hour) in a high intensity burn area of Bobcat Gulch was conducted to provide an indication of potential runoff and flooding conditions. Preliminary results suggest that overland flow (runoff) begins in two minutes and continues at an increasing rate up to seven minutes at which point runoff was essentially equal to rainfall input.

Mixed ownership is prevalent in and adjacent to the burn area. Seasonal and year round residential development is common, especially in the Cedar Park area. The general area is heavily used by local residents as well as others for a variety of recreational and aesthetic purposes. Due to the amount and type of human uses in the area, there are significant threats to public safety as a result of the fire. Hazard trees (burned trees with a high risk of falling) along roads and trails and near structures pose a threat to public safety. There is an increased potential for damage to infrastructure, especially the road system, as a result of expected increases in runoff as a result of the fire. Damage to the road system (e.g.a failed culvert) could limit access in and out of certain areas (e.g. Cedar Park) for periods of time, posing a public health threat as well as causing significant damage to infrastructure and water quality. Municipal and agricultural water facilities and users downstream of the fire area are at increased risk due to potential water quality degradation from runoff and erosion from the burn area.

Bobcat Gulch: Approximately 30% of Bobcat Gulch watershed burned with high intensity crown fire in a large block of the upper watershed. Fire severity is high to moderate, with a strong, but thin water repellent layer at the surface. A few areas show signs of hydrophobic conditions below the surface (1"), but these areas are generally disconnected. Soils are deep sandy loams. Erosion, runoff and flood potential are expected to be high as a result of fire severity, micaceous soils, and steep slopes. Potential for increased runoff, flooding and erosion could result in damage to roads in the area, as well as a few homes near the confluence of Bobcat Gulch and the North Fork Big Thompson. Increased runoff poses a significant risk to the upper and lower portions of the Cedar Park Road (FDR 128) in the Bobcat Gulch watershed. Drainage failure on the lower Cedar Park Road could limit access to residential developments in the Cedar Park area, as it is the only developed access to route.

Cedar Creek: Upper portions of the Cedar Creek drainage burned with an intense crown fire, especially portions of Dry Creek and Jug Gulch. Fire in this area burned in a mosaic of smaller blocks, as compared to Bobcat Gulch. Fire severity is high to moderate, with a strong but thin water repellent layer at the surface. Soils are deep sandy loams. Erosion, runoff and flood potential are expected to be moderate as a result of mixed fire severity, moderate slopes and the smaller percentage of the watershed burned. Roads in and downstream of the burn area are at risk for drainage failure and resulting impacts downstream. Structures in the floodplain near Cedar Cove, approximately 5 miles downstream from the fire perimeter, are at an increased risk due to increased flood hazard.

Green Ridge: Green Ridge is an igneous intrusion with coarse granitic soils on the top of the ridge. Much of the Green Ridge area received high intensity crown fire. Fire severity is high in the coarser granitic soils area with signs of strong hydrophobicity both at and below the surface. High fire severity has consumed much of the seed source in this area. Runoff and erosion are expected to increase. Potential for flooding in the ephemeral draws on the east side of Green Ridge is moderate, but is not expected to change flood hazard significantly in Buckhorn Creek. Roads in the area are threatened from increased runoff.

Small portions of Galuchie Gulch, Bear Gulch and Sulzer Gulch were affected by the fire. Due to the small amount of these drainages affected and limited fire severity, natural recovery is expected to occur rapidly in these areas. No watershed emergency is believed to exist in these areas.

**B. Emergency Treatment Objectives:**

A variety of emergency treatments are recommended to significantly reduce the risk of emergency watershed conditions and threats to public health and safety. Treatment objectives designed to reduce the increased risk to public health and safety in this heavily used and populated area include:

a) mitigation of fire effects to the road and trail system,
b) increasing public awareness of hazards, including implementation of an emergency flood warning system, and
c) hazard tree assessments and removal.

Treatments designed to reduce the areas with increased risk to flooding, water quality and soil erosion/productivity include:

a) a mix of seeding/mulching and contour treatments to promote infiltration and increase cover,
b) mitigation of fire effects to the road and trail system, and
c) integrated pest management to control the spread of noxious weeds in the burn area.

A treatments designed to protect key habitat areas for the Preble's Meadow Jumping Mouse, a Federally Threatened species is to:

a) seed two key high intensity burn riparian areas in Little Bear Gulch and one in Dry Gulch to promote infiltration and increase vegetative cover and prevent habitat loss from sedimentation.

Coordination and cooperation between private landowners and federal land managers is critical to the implementation and effectiveness of these treatments within and downstream of the burn area.

**Land Treatments:**

**Purpose:** To minimize soil loss, help maintain soil productivity, increase infiltration, and reduce runoff and expected increases in peak streamflows.

**Treatment 1:** Seed critical high severity burn areas, especially portions of Green Ridge and Bobcat Gulch, and Preble's Meadow Jumping Mouse and other areas with high erosion and/or runoff potential. Seeding will be applied by air or by hand at a rate of 40 pure live seed per square foot (PLS/SF). Regreen, a temporary cover crop that produces sterile seed, germinates quickly and has a dense fibourous root mass is the recommended seed.

***Effectiveness:*** Due to timing of application (summer) and germination period, seeding will have very little effect for the critical climatic period (July/Aug) during 2000. Seeding has the potential to be more effective than natural revegetation starting in fall 2000 and continuing through 2002, especially in areas like Green Ridge which burned with high severity. Inspection of several sites in the high intensity burn areas indicated healthy viable root mats just under the soil surface, and natural revegetation is expected to occur on most areas within 3 years.

**Treatment 2:** Mulch and/or contour treat critical high severity burn areas, especially portions of Bobcat Gulch and other areas with high erosion and/or runoff potential. Mulch will be applied at a rate of 1 ton/acre using material (e.g. rice, wheat, oat or sorghum straw or wood chips) which is certified weed free and which is unlikely to reproduce on site, if non-native. Contour treatments would include contour-felled logs, straw wattles and/or sandbags.

***Effectiveness:*** Mulch can be effective immediately following application and remain effective for several years. Mulch is expected to improve seed germination. Mulch has been shown to reduce erosion rates by 6 to 10 cubic yards per acre. Effectiveness within the fire perimeter will be limited due to steep slopes and potential for wind or rain to move the mulch offsite.

Contour treatments can also be effective immediately following application. Sediment accumulation behind logs generally reduces the infiltration effectiveness of contour-felled logs after a few storms. Contour-felled logs can be applied more effectively than mulch on many of the steeper slopes within the burn perimeter. The small number of large diameter trees (> 8" d.b.h.) in the burn area may limit widespread application of this method or require the use of off-site materials such as straw wattles.

**Treatment 3:** Grazing on the Cedar Park allotment will be deferred for at least 1 year and up to 3 years, to allow vegetative recovery in the burn area.

***Effectiveness:*** Deferred grazing within the burn area will increase the effectiveness of seeding and natural revegetation efforts.

**Treatment 4:** Integrated Pest Management (IPM) will be used to control the spread of noxious weeds in the burn area for three years following the fire. A combination of biological, chemical and grazing techniques will be used.

***Effectiveness:*** Noxious weed treatments must occur annually over at least three years after the fire to be effective.

**Channel Treatments:**

**Purpose:** Reduce the likelihood of debris torrents that may affect downstream values at risk.

**Treatment 1:** Construct debris basins in ephemeral draws with a high risk of flooding or debris flows.

***Effectiveness:*** Limited information on the effectiveness of debris basins was available. Debris basins could be effective immediately following installation.

**Roads and Trail Treatments:**

**Purpose:** Reduce the risk of transportation system drainage failure which could increase erosion, sedimentation, and cause downstream damage.

**Treatment 1:** Armor approximately 150 culvert inlets and outlets which are expected to receive increased flows and/or have minimal ground cover protection below outlet as a result of intense burning.

***Effectiveness:*** Armoring is effective immediately following installation and will remain effective over time in the burn area. Scour at inlet and outlet is reduced, although culvert capacity/efficiency is not expected to change.

**Treatment 2:** Inspect and clean approximately 150 culverts (storm patrol).

***Effectiveness:*** Patrol can be effective to clear and maintain culvert entrances during storms.

**Treatment 3:** Install additional drainage capacity (approximately 35 culverts and 100 waterbars/driveable dips) to accommodate increased runoff as a result of the fire.

***Effectiveness:*** Additional drainage capacity is very effective immediately following installation and will remain effective over time in the burn area. Effectiveness is limited by the ability to quickly and accurately determine the increased size of culvert necessary to accommodate increased peak flows.

**Treatment 4:** Upgrade major culvert and bridge crossings (10 on Cedar Creek (FDR 102) and Bobcat Gulch (FDR 128)) to accommodate potential increased streamflow as a result of the fire.

***Effectiveness:*** Additional drainage capacity is very effective immediately following installation and will remain effective over time in the burn area. Effectiveness is limited by the ability to determine quickly and accurately the increased size of culvert necessary to accommodate increased peak flows.

**Purpose:** Reduce the risk to human life from burned “hazard” trees along roads and trails.

**Treatment 1:** Survey roads, and trails within high intensity burn areas for hazard trees. To the degree landowners allow, remove those trees identified as hazardous to public safety.

***Effectiveness:*** Assessment and removal of hazard trees is believed to be a very effective means to protect public safety along roads and trails.

**Structures:**

**Purpose:** Reduce the risk to human life from burned "hazard" trees near structures.

**Treatment 1:** Survey dwelling and high use structures within high intense burn areas for hazard trees. As permitted, remove those trees identified as hazardous to public safety.

***Effectiveness:*** Assessment and removal of hazard trees is believed to be a very effective means to protect public safety near structures.

**Other:**

**Purpose:** Reduce the risk to public health and safety.

**Treatment 1:** Provide public information (brochures, public meetings, personal contacts, etc.) to increase the knowledge about hazards which exist from the recent fire in the area, such as hazard trees, increased flood hazard.

***Effectiveness:*** Can be highly effective in reducing risk to public safety and mitigating effect to structural damage. Only treatment which provides some level of effectiveness in the event of a rare, but extreme climatic event.

**Treatment 2:** Install a weather monitoring station in burn area that links to an emergency flood warning system. Flood warning would be issued to residents at risk as well as downstream water users who may be affected by flood flows.

***Effectiveness:*** Can be highly effective in reducing risk to public safety and mitigating effect to structural damage and downstream values. Provides downstream residences, water users and others time to evacuate flood prone areas and/or adjust operations to minimize impacts of flood flows and degraded water quality. Only treatment which provides some level of effectiveness in the event of a rare, but extreme climatic event.

### C. Probability of Completing Treatments Prior to First Major Damage-Producing Storm:

The Bobcat fire area sits directly in an area very prone to localized but sometimes very intense rainfall with a maximum climatological probability of occurrence from mid July through mid August. More widespread precipitation events, but at lower rainfall intensities, are most common over that area from late April through early June and again in September and early October (personal communication with Nolan Doesken, Colorado Climate Center, 6/21/00).

Assuming the first major damage-producing storm occurs on July 15, the estimated probability of completing treatments before that time is shown below:

Land: 20% Channel Treatments: 5% Roads: 70% Other: 90%

Assuming the first major damage-producing storm occurs on August 15, the estimated probability of completing treatments before that time is shown below:

Land: 80% Channel Treatments: 80% Roads: 90% Other: 100%

### D. Probability of Treatment Success

Probability of treatment success can be controlled by planning, design and quick implementation of appropriate and effective treatments. Probability of treatment success is also dependant on climatic conditions, which cannot be controlled. Probability of treatment success is estimated for the basic categories of treatments below.

| | Years after treatments | | |
|---|---|---|---|
| | **1** | **3** | **5** |
| **Land** | 50 | 70 | 90 |
| **Channel** | 20 | 30 | 40 |
| **Roads** | 70 | 80 | 90 |
| **Other** | 90 | 90 | 90 |

**E. Cost of No Action (Including Loss):** $5,260,000

**F. Cost of Selected Alternative (Including Loss):** $1,487,394

**G. Skills Represented on Burn Area SurveyTeam:**

| | | | |
|---|---|---|---|
| XX Hydrology | XX Soils | Geology | XX Range |
| XX Timber | XX Wildlife | XX Fire Mgmt. | XX Engineering |
| Contracting | XX Ecology | XX Research | XX Archeology |

Team Leader: Dave Gloss
Phone: (970) 498-1092 email: dgloss@fs.fed.us

**RECOMMENDED - INTERIM REQUEST 7/24/00**

**PART VI - EMERGENCY REHABILITATION TREATMENTS & SOURCE OF FUNDS BY LAND OWNERSHIP**

| | | | NFS LANDS | | | PRIVATE LANDS | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Line Items** | **Units** | **Unit Cost $** | **Number of Units** | **FFFS-FW22 $** | **Other $** | **Number of Units** | **Fed $** | **Non-Fed $** | **Total** |
| **A. LAND TREATMENTS** | | | | | | | | | |
| Seeding | acre | $140 | 1200 | $168,000 | | 1610 | $169,050 | $56,350 | $393,400 |
| Mulching | acre | $400 | 600 | $240,000 | | 250 | $75,000 | $25,000 | $340,000 |
| Contour Infiltration Treatments | acre | $400 | 450 | $180,000 | | 250 | $75,000 | $25,000 | $280,000 |
| Deferred Grazing | | | | $0 | | | $0 | $0 | $0 |
| IPM - Grazing | acre | $0.85 | 7295 | $6,201 | | 3304 | $2,106 | $702 | $9,009 |
| IPM - Chemical | acre | $125 | 366 | $45,750 | | 164 | $15,375 | $5,125 | $66,250 |
| IPM - Biological | each | $1,000 | 1 | $1,000 | | 1 | $750 | $250 | $2,000 |
| **B. CHANNEL TREATMENTS** | | | | | | | | | |
| Debris Basins | each | $7,500 | 0 | $0 | | 20 | $112,500 | $37,500 | $150,000 |
| **C. ROAD AND TRAIL TREATMENTS** | | | | | | | | | |
| Culvert Armoring | each | $300 | 117 | $35,100 | | 36 | $8,100 | $2,700 | $45,900 |
| Storm Patrol | miles | $100 | 19 | $1,900 | | 34 | $2,550 | $850 | $5,300 |
| Additional Culvert Capacity | each | $1,000 | 20 | $20,000 | | 14 | $10,500 | $3,500 | $34,000 |
| Waterbars/Dips | each | $250 | 60 | $15,000 | | 40 | $7,500 | $2,500 | $25,000 |
| Major Crossing Upgrades | each | $10,000 | 6 | $60,000 | | 4 | $30,000 | $10,000 | $100,000 |
| Hazard Tree Survey | miles | $13 | 19 | $247 | | 13 | $127 | $42 | $416 |
| Hazard Tree Removal | miles | $67 | 19 | $1,273 | | 13 | $653 | $218 | $2,144 |
| **D. STRUCTURES** | | | | | | | | | |
| Hazard Tree Survey | structure | $26 | 0 | $0 | | 25 | $488 | $163 | $650 |
| Hazard Tree Removal | structure | $33 | 0 | $0 | | 25 | $619 | $206 | $825 |
| **E. OTHER** | | | | | | | | | |
| Public Information | each | $15,000 | 1 | $15,000 | | 1 | $11,250 | $3,750 | $30,000 |
| Emer. Warning System | each | $3,500 | 1 | $3,500 | | 1 | $2,625 | $875 | $7,000 |
| **F. BAER EVALUATION/ADMINISTRATIVE SUPPORT** | | | | | | | | | |
| Survey/assessment team | each | $24,000 | 1 | $24,000 | | 1 | $18,000 | $6,000 | $48,000 |
| BAER Implementation Team | each | $100,000 | 1 | $100,000 | | 1 | $75,000 | $25,000 | $200,000 |
| **G. MONITORING PLAN** | | | | | | | | | |
| Monitoring Plan | each | $48,000 | 1 | $48,000 | | | | | $48,000 |
| **TOTALS:** | | | | $964,971 | | | $617,193 | $205,731 | $1,787,894 |

# Bobcat Fire - Post-fire Burn Area Emergency Rehabilitation Monitoring Plan

## Goal

Determine if emergency treatments were effective at significantly reducing the risk of emergency watershed conditions and threats to public health and safety, as compared to the no treatment option.

## Objectives

The following objectives were adapted from the Burn Area Emergency Rehabilitation Handbook (FSH 2509.13,60) to meet conditions on the Bobcat Fire. Activities proposed below address these objectives.

(1) Determine the effectiveness of emergency treatments. (Proposed Activities #1-6)

(2). Determine the need for retreatment and maintenance of emergency treatments. (Proposed Activity #1)

(3) Determine the quality and quantity of water leaving the burned area, and the location and causes of the problems. (Proposed Activity #5)

(4) Determine the rate of recovery of vegetation. (Proposed Activity #6)

## Background

Determining effective treatments to address emergency watershed conditions was hampered by a general lack of information on:

(1) variability in post-fire runoff and erosion rates as a function of fire severity, vegetation type, and soil type;
(2) presence or absence of a hydrophobic layer, again as a function of fire severity, vegetation type, and soil type;
(3) recovery rates for runoff, hydrophobicity, and soil erosion, respectively; and
(4) effectiveness of different burn area rehabilitation techniques, as a function of the the conditions listed above.

Research and observations indicated that high-severity fires can alter runoff processes in forested areas, resulting in large increases in post-fire runoff and erosion. These effects are typically ascribed to hydrophobic soil layers, but there have been almost no studies that have linked larger-scale changes in runoff and erosion with specific smaller-scale changes in infiltration and erosion processes. A primary goal of emergency treatments for the Bobcat Fire is to minimize the risk of larger-scale changes in runoff and erosion, through the use of site specific techniques to increase infiltration and reduce erosion. The Bobcat Fire offers a unique opportunity to evaluate these questions, as it can build on existing research being conducted on post-fire hydrophobicity, runoff, and erosion. Of particular importance is the opportunity to link measurements at different spatial scales in order to better understand the causal processes and the effect of changing spatial scale.

## Proposed activities

*Prompt implementation, and correct application of emergency treatments is necessary to maximize their potential effectiveness before the first damage producing storm. Monitoring prompt implementation and correct application of emergency treatments is fundamental to assessing emergency treatment successes and failures and the reasons for the results.*

(1) Monitor implementation. A key component to interpreting the larger-scale data is to determine the extent to which the proposed treatments were implemented as planned. The vegetation monitoring will provide specific data on the hillslopes, but this component of the monitoring plan will also involve repeated evaluations of the mulching, contour-log structures, road improvements and elimination of hazard trees. Most of this will be conducted in the latter half of 2000, and the estimated cost is $11,000.

*Hydrophobic soil conditions, resulting in increased runoff and erosion, are one of the major concerns documented in the burn area assessment and the primary reason for prescribing land treatments. Monitoring recovery rates of hydrophobic soils in treated and untreated areas is fundamental to determining whether emergency treatments effectively reduced increased in runoff and erosion, as compared to the no treatment option.*

(2) Monitor post-fire hydrophobicity as a function of fire severity, soil type, vegetation, soil depth, and time since burning in treated and untreated sites. A study of older fires is already underway, but the Bobcat Fire offers the opportunity to directly measure recovery rates over time. We propose a detailed monitoring of hydrophobicity at 15 or more sites at a minimum of three times: July 2000 (as soon after the burn as practical); in mid-fall 2000, after the summer rains but before any winter snowfall; and in summer 2001 to evaluate the rate of recovery. The sites will be focused in moderate-high severity areas, but we will also monitor natural hydrophobicity in unburned sites. Each site will consist of a minimum of two pits and multiple samples at different layers in each pit. If hydrophobicity is no greater than the natural hydrophobicity in unburned areas, monitoring will be stopped. However, if hydrophobicity is still present in summer 2001, we would like to extend the monitoring at the same frequency until it approaches background levels or is sufficiently discontinuous that changes in runoff are not apparent at the catchment scale (see below). Estimated cost: $20,000.

*The purpose of Bobcat BAER emergency land treatments are to minimize soils loss, increase infiltration and reduce runoff runoff. Monitoring runoff and erosion rates in treated and untreated areas with different fire severity and soil types is fundamental to determining whether emergency treatments effectively minimized soil loss, increased infiltration and reduced runoff, as compared to the no treatment option.*

(3) Monitor runoff and erosion at the plot scale using a rainfall simulator in treated and untreated sites. An existing rainfall simulator will be used to apply rainfall on 1 $m^2$ plots at a rate of approximately 85 mm/hr. These plot-scale studies will directly evaluate infiltration, runoff, and erosion rates, and these data will complement both the smaller-scale hydrophobicity monitoring and the larger-scale monitoring efforts described below. The use of the rainfall simulator will allow a more standardized comparison and monitoring of runoff and erosion processes in areas that vary by soil type and fire severity. Because this operation is much more labor intensive and each run generates about 25 sediment samples that must be processed, we expect to be able to complete about 10-16 plots in the Bobcat Fire in 2000. Most of these plots will be in burned, untreated areas, but some plots will also be located in unburned areas to serve as a control. Several plots will also be located on treatments for which there is little existing runoff and erosion data, but for practical reasons the effectiveness of most treatments will be evaluated in 2000 at the hillslope scale as described below. Approximately $8,000 is requested for 2000 as this work can build on an existing project, while $12,000 is allocated for 2001. The intent is to redo about two-thirds of the plots studied in 2000, and do additional plots on the treated areas so that we can compare the recovery rates between treated and untreated sites. Hence total estimated cost is approximately $20,000.

*The potential for increased sediment production as a result of the fire, was identified as a concern to downstream values at risk in the burn area assessment and one of the primary reason for prescribing*

*land treatments. Monitoring sediment production rates in treated and untreated areas is fundamental to determining whether emergency treatments effectively minimized potential risks to downstream values, as compared to the no treatment option.*

(4) Measure sediment production rates at the hillslope scale in treated and untreated sites. The hydrophobicity monitoring and rainfall simulator data will provide a basic understanding of runoff and erosion processes at the smaller scales, and the recovery of these processes over time. Since one of the major concerns is sediment production, we proposed to monitor sediment production at the hillslope scale for burned and untreated areas, burned and treated sites, and unburned controls. We expect to install approximately 20 sediment fences as soon as possible, and hopefully before any significant rainfall events. Sediment accumulations will be monitored over the summer and fall, and again in the summer of 2001. Weight of accumulated sediment will be measured in the field, and samples will be taken for drying in the lab and converting the wet weights to dry weights. Particle-size analyses will be done to compare the sediment being transported against the soil textures, and to evaluate the threat to downstream resources. Precipitation will be monitored with 4 rain gages during the summer months. Estimated cost is $10,000 in 2000 and $7000 in 2001.

*The potential for increased runoff, flooding, and suspended sediment as a result of the fire, was identified as a concern to downstream values at risk in the burn area assessment and one of the primary reason for prescribing land treatments. Monitoring runoff and suspended sediment at the catchment scale is fundamental to determining whether emergency treatments effectively minimized potential risks to downstream values, as compared to the no treatment option.*

(5) Monitor runoff and suspended sediment concentrations at the catchment scale. At this scale it is not possible to determine the effect of individual treatments, but this scale is the most important for downstream water users and flood protection. We are specifically proposing to monitor runoff and suspended sediment concentrations at three locations: Bobcat Gulch, Jug Gulch, and Cedar Creek. At each site we will install a pressure transducer and single-channel data logger, and a pump sampler. These will be monitored from the summer of 2000 through the summer of 2001. The interpretation of the runoff and sediment yield data will also be complicated by the lack of pre-fire data, but the smaller-scale monitoring efforts described previously will allow us to interpret the data collected at this larger scale. The estimated cost for these three stations is $35,000.

*The purpose of Bobcat BAER emergency land treatments are to minimize soils loss, increase infiltration and reduce runoff runoff. Natural vegetative recovery is expected in three years. Monitoring vegetative recovery in treated and untreated areas with different fire severity and soil types is fundamental to determining whether emergency treatments effectively minimized soil loss, increased infiltration and reduced runoff, as compared to the no treatment option.*

(6) Monitor vegetation. The vegetative recovery will be measured at different scales in both treated and untreated sites. Detailed cover data are collected for each of the rainfall simulator plots and the sediment fences. Other transects will be run to compare the vegetative cover on different severity and treatments in late summer 2000, in early summer 2001, and again in late summer 2001. Estimated cost to collect and analyze the data is $12,000.

## PART VII - APPROVALS

The Forest considered three treatment options. The recommended treatment option is shown in Part VI. Other options considered are attached at the end of this report. The recommended option combines two of the original alternatives chosen to emphasize treatments which will be most effective immediately after implementation (e.g. mulch) and de-emphasize treatments which are less effective in the first season (e.g. seeding).

The Arapaho and Roosevelt National Forest does not have sufficient resources locally to implement the recommended treatments in a timely fashion. A Type III Incident Command structure (IC, Logistics, Financial, Operations), at a minimum will be required to implement the treatments. This will require additional funding, beyond what is shown in Part VI, to accommodate this logistical support.

***/s/ Jeffrey M. Losche** for* 6/26/00
James S. Bedwell date
Forest Supervisor

Revisions approved, based on suggestions from Regional BAER coordinator:

***/s/ Michael W. Foley** for* 6/28/00
James S. Bedwell date
Forest Supervisor

Revised interim request approved by:

/s/ Michael W. Foley 7/24/00
James S. Bedwell date
Forest Supervisor

/s/ DeAnn Zwight for 7/25/00
Lyle Laverty date
Regional Forester

**OPTION 1 - EMERGENCY REHABILITATION TREATMENTS AND SOURCE OF FUNDS BY LAND OWNERSHIP**

| | | | NFS LANDS | | | PRIVATE LANDS | | | |
|---|---|---|---|---|---|---|---|---|---|
| Line Items | Units | Unit Cost $ | Number of Units | FFFS-FW22 $ | Other $ | Number of Units | Fed $ | Non-Fed $ | Total |
| **A. LAND TREATMENTS** | | | | | | | | | |
| Seeding | acre | $90 | 800 | $72,000 | | 1610 | $108,675 | $36,225 | $216,900 |
| Mulching | acre | $400 | 150 | $60,000 | | 250 | $75,000 | $25,000 | $160,000 |
| Log Contour Felling | acre | $400 | 100 | $40,000 | | 250 | $75,000 | $25,000 | $140,000 |
| Deferred Grazing | | | | $0 | | | $0 | $0 | $0 |
| IPM - Grazing | acre | $0.85 | 7295 | $6,201 | | 3304 | $2,106 | $702 | $9,009 |
| IPM - Chemical | acre | $25 | 366 | $9,150 | | 164 | $3,075 | $1,025 | $13,250 |
| IPM - Biological | each | $1,000 | 1 | $1,000 | | 1 | $750 | $250 | $2,000 |
| | | | | | | | | | |
| **B. CHANNEL TREATMENTS** | | | | | | | | | |
| Debris Basins | each | $7,500 | 0 | $0 | | 20 | $112,500 | $37,500 | $150,000 |
| | | | | | | | | | |
| **C. ROAD AND TRAIL TREATMENTS** | | | | | | | | | |
| Culvert Armoring | each | $300 | 117 | $35,100 | | 36 | $8,100 | $2,700 | $45,900 |
| Storm Patrol | miles | $100 | 19 | $1,900 | | 34 | $2,550 | $850 | $5,300 |
| Additional Culvert Capacity | each | $1,000 | 20 | $20,000 | | 14 | $10,500 | $3,500 | $34,000 |
| Waterbars/Dips | each | $250 | 60 | $15,000 | | 40 | $7,500 | $2,500 | $25,000 |
| Major Crossing Upgrades | each | $10,000 | 6 | $60,000 | | 4 | $30,000 | $10,000 | $100,000 |
| Hazard Tree Survey | miles | $13 | 19 | $247 | | 13 | $127 | $42 | $416 |
| Hazard Tree Removal | miles | $67 | 19 | $1,273 | | 13 | $653 | $218 | $2,144 |
| | | | | | | | | | |
| **D. STRUCTURES** | | | | | | | | | |
| Hazard Tree Survey | structure | $26 | 0 | $0 | | 25 | $488 | $163 | $650 |
| Hazard Tree Removal | structure | $33 | 0 | $0 | | 25 | $619 | $206 | $825 |
| | | | | | | | | | |
| **E. OTHER** | | | | | | | | | |
| Public Information | each | $15,000 | 1 | $15,000 | | 1 | $11,250 | $3,750 | $30,000 |
| Emer. Warning System | each | $3,500 | 1 | $3,500 | | 1 | $2,625 | $875 | $7,000 |
| | | | | | | | | | |
| **F. BAER EVALUATION/ADMINISTRATIVE SUPPORT** | | | | | | | | | |
| Survey/assessment team | each | $24,000 | 1 | $24,000 | | 1 | $18,000 | $6,000 | $48,000 |
| | | | | | | | | | |
| **G. MONITORING PLAN** | | | | | | | | | |
| Monitoring Plan | each | $108,000 | 1 | $108,000 | | | | | $108,000 |
| **TOTALS:** | | | | $472,371 | | | $469,518 | $156,506 | $1,098,394 |

**OPTION 2 - EMERGENCY REHABILITATION TREATMENTS AND SOURCE OF FUNDS BY LAND OWNERSHIP**

| | | | NFS LANDS | | | PRIVATE LANDS | | | |
|---|---|---|---|---|---|---|---|---|---|
| Line Items | Units | Unit Cost $ | Number of Units | FFFS-FW22 $ | Other $ | Number of Units | Fed $ | Non-Fed $ | Total |
| **A. LAND TREATMENTS** | | | | | | | | | |
| Seeding | acre | $90 | 3200 | $288,000 | | 1610 | $108,675 | $36,225 | $432,900 |
| Mulching | acre | $400 | 600 | $240,000 | | 250 | $75,000 | $25,000 | $340,000 |
| Log Contour Felling | acre | $400 | 400 | $160,000 | | 250 | $75,000 | $25,000 | $260,000 |
| Deferred Grazing | | | | $0 | | | $0 | $0 | $0 |
| IPM - Grazing | acre | $0.85 | 7295 | $6,201 | | 3304 | $2,106 | $702 | $9,009 |
| IPM - Chemical | acre | $25 | 366 | $9,150 | | 164 | $3,075 | $1,025 | $13,250 |
| IPM - Biological | each | $1,000 | 1 | $1,000 | | 1 | $750 | $250 | $2,000 |
| | | | | | | | | | |
| **B. CHANNEL TREATMENTS** | | | | | | | | | |
| Debris Basins | each | $7,500 | 0 | $0 | | 20 | $112,500 | $37,500 | $150,000 |
| | | | | | | | | | |
| **C. ROAD AND TRAIL TREATMENTS** | | | | | | | | | |
| Culvert Armoring | each | $300 | 117 | $35,100 | | 36 | $8,100 | $2,700 | $45,900 |
| Storm Patrol | miles | $100 | 19 | $1,900 | | 34 | $2,550 | $850 | $5,300 |
| Additional Culvert Capacity | each | $1,000 | 20 | $20,000 | | 14 | $10,500 | $3,500 | $34,000 |
| Waterbars/Dips | each | $250 | 60 | $15,000 | | 40 | $7,500 | $2,500 | $25,000 |
| Major Crossing Upgrades | each | $10,000 | 6 | $60,000 | | 4 | $30,000 | $10,000 | $100,000 |
| Hazard Tree Survey | miles | $13 | 19 | $247 | | 13 | $127 | $42 | $416 |
| Hazard Tree Removal | miles | $67 | 19 | $1,273 | | 13 | $653 | $218 | $2,144 |
| | | | | | | | | | |
| **D. STRUCTURES** | | | | | | | | | |
| Hazard Tree Survey | structure | $26 | 0 | $0 | | 25 | $488 | $163 | $650 |
| Hazard Tree Removal | structure | $33 | 0 | $0 | | 25 | $619 | $206 | $825 |
| | | | | | | | | | |
| **E. OTHER** | | | | | | | | | |
| Public Information | each | $15,000 | 1 | $15,000 | | 1 | $11,250 | $3,750 | $30,000 |
| Emer. Warning System | each | $3,500 | 1 | $3,500 | | 1 | $2,625 | $875 | $7,000 |
| | | | | | | | | | |
| **F. BAER EVALUATION/ADMINISTRATIVE SUPPORT** | | | | | | | | | |
| Survey/assessment team | each | $24,000 | 1 | $24,000 | | 1 | $18,000 | $6,000 | $48,000 |
| | | | | | | | | | |
| **G. MONITORING PLAN** | | | | | | | | | |
| Monitoring Plan | each | $108,000 | 1 | $108,000 | | | | | $108,000 |
| **TOTALS:** | | | | $988,371 | | | $469,518 | $156,506 | $1,614,394 |

**OPTION 3 - EMERGENCY REHABILITATION TREATMENTS AND SOURCE OF FUNDS BY LAND OWNERSHIP**

| | | | NFS LANDS | | | PRIVATE LANDS | | | |
|---|---|---|---|---|---|---|---|---|---|
| Line Items | Units | Unit Cost $ | Number of Units | FFFS-FW22 $ | Other $ | Number of Units | Fed $ | Non-Fed $ | Total |
| **A. LAND TREATMENTS** | | | | | | | | | |
| Seeding | acre | $90 | 5000 | $450,000 | | 1610 | $108,675 | $36,225 | $594,900 |
| Mulching | acre | $400 | 600 | $240,000 | | 250 | $75,000 | $25,000 | $340,000 |
| Log Contour Felling | acre | $400 | 400 | $160,000 | | 250 | $75,000 | $25,000 | $260,000 |
| Deferred Grazing | | | | $0 | | | $0 | $0 | $0 |
| IPM - Grazing | acre | $0.85 | 7295 | $6,201 | | 3304 | $2,106 | $702 | $9,009 |
| IPM - Chemical | acre | $25 | 366 | $9,150 | | 164 | $3,075 | $1,025 | $13,250 |
| IPM - Biological | each | $1,000 | 1 | $1,000 | | 1 | $750 | $250 | $2,000 |
| | | | | | | | | | |
| **B. CHANNEL TREATMENTS** | | | | | | | | | |
| Debris Basins | each | $7,500 | 0 | $0 | | 20 | $112,500 | $37,500 | $150,000 |
| | | | | | | | | | |
| **C. ROAD AND TRAIL TREATMENTS** | | | | | | | | | |
| Culvert Armoring | each | $300 | 117 | $35,100 | | 36 | $8,100 | $2,700 | $45,900 |
| Storm Patrol | miles | $100 | 19 | $1,900 | | 34 | $2,550 | $850 | $5,300 |
| Additional Culvert Capacity | each | $1,000 | 20 | $20,000 | | 14 | $10,500 | $3,500 | $34,000 |
| Waterbars/Dips | each | $250 | 60 | $15,000 | | 40 | $7,500 | $2,500 | $25,000 |
| Major Crossing Upgrades | each | $10,000 | 6 | $60,000 | | 4 | $30,000 | $10,000 | $100,000 |
| Hazard Tree Survey | miles | $13 | 19 | $247 | | 13 | $127 | $42 | $416 |
| Hazard Tree Removal | miles | $67 | 19 | $1,273 | | 13 | $653 | $218 | $2,144 |
| | | | | | | | | | |
| **D. STRUCTURES** | | | | | | | | | |
| Hazard Tree Survey | structure | $26 | 0 | $0 | | 25 | $488 | $163 | $650 |
| Hazard Tree Removal | structure | $33 | 0 | $0 | | 25 | $619 | $206 | $825 |
| | | | | | | | | | |
| **E. OTHER** | | | | | | | | | |
| Public Information | each | $15,000 | 1 | $15,000 | | 1 | $11,250 | $3,750 | $30,000 |
| Emer. Warning System | each | $3,500 | 1 | $3,500 | | 1 | $2,625 | $875 | $7,000 |
| | | | | | | | | | |
| **F. BAER EVALUATION/ADMINISTRATIVE SUPPORT** | | | | | | | | | |
| Survey/assessment team | each | $24,000 | 1 | $24,000 | | 1 | $18,000 | $6,000 | $48,000 |
| | | | | | | | | | |
| **G. MONITORING PLAN** | | | | | | | | | |
| Monitoring Plan | each | $108,000 | 1 | $108,000 | | | | | $108,000 |
| **TOTALS:** | | | | $1,150,371 | | | $469,518 | $156,506 | $1,776,394 |