USDA-FOREST SERVICE FS-2500-8

Date of Report:05/22/2013

BURNED-AREA REPORT
(Reference FSH 2509.13)

PART I - TYPE OF REQUEST

A. Type of Report

[x] 1. Funding request for estimated emergency stabilization funds
[ ] 2. Accomplishment Report
[ ] 3. No Treatment Recommendation

B. Type of Action

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

[x] 2. Interim Report # 1
[x] Updating the initial funding request based on more accurate site data or design analysis
2013 Updates to the original BAER Report are highlighted in yellow within this report. Updates occur in the treatment narrative section, the monitoring section and the Summary of BAER Costs Table
[ ] Status of accomplishments to date

[ ] 3. Final Report (Following completion of work)

PART II - BURNED-AREA DESCRIPTION

A. Fire Name: High Park

B. Fire Number:CO LRX GW7N

C. State: CO

D. County: Larimer

E. Region: 2

F. Forest: ARNF-PNG

G. District: Canyon Lakes

H. Fire Incident Job Code: PNGW79

I. Date Fire Started: 06/09/2012

J. Date Fire Contained: 07/01/2012

K. Suppression Cost: Approx. $39.2 million at time of BAER Report.

L. Fire Suppression Damages Repaired with Suppression Funds

1. Fireline (dozerline) waterbarred (miles): 30 (of 33 miles constructed)
2. Fireline seeded (miles): 0
3. Handline: 13 miles of handline constructed, 13 miles repaired (covered, scarified, and waterbarrered
4. Chipping: 42 miles (approximately 30' on fire-side of road) of roadside hazard tree chipping was completed as part of suppression activities

M. Watershed Numbers:

Watershed Number	Watershed Name	ACRES
101900070805	City of Fort Collins-Cache La Poudre River	16670
101900070303	Skin Gulch-Cache La Poudre River	13310
101900070105	Pendergrass Creek-South Fork Cache La Poudre River	11234
101900070302	Youngs Gulch	9217
101900070305	Hill Gulch-Cache La Poudre River	8784
101900060303	Redstone Creek	8460
101900060301	Upper Buckhorn Creek	7643
101900060302	Middle Buckhorn Creek	4466
101900070304	Gordon Creek	4156
101900070209	Bennett Creek	1611
101900070210	Sevenmile Creek-Cache La Poudre River	1163
101900070802	Horsetooth Reservoir	410
101900070704	Milton Seaman Reservoir-North Fork Cache La Poudre River	266
101900070104	Little Beaver Creek	96
		87487

At approximately 87,487 acres, the High Park Fire is the largest recorded fire in the northern foothills of the Front Range and/or Larimer County (USFS fire history layer).

The northern and northwestern part of the burned area is within 9 HUC6 Watersheds (Skin Gulch-Cache la Poudre, Pendergrass Creek-South Fork Cache La Poudre River, Youngs Gulch, Hill Gulch-Cache la Poudre, Gordon Creek, Bennett Creek and small proportions of Sevenmile Creek, Little Beaver Creek, and Milton Seamen Reservoir-North Fork Cache la Poudre River). These watersheds are tributary to the Cache la Poudre River and confluence at various locations within Poudre Canyon, northwest of the City of Fort Collins.

The eastern part of the burned area is within 2 HUC6 Watersheds (City of Fort Collins-Cache La Poudre River and a small part of Horsetooth Reservoir) These watersheds drain primarily east towards the City of Fort Collins. The natural drainage pattern is heavily modified by water conveyance and storage facilities just west of Fort Collins.

The southern part of the burned area is within of 3 HUC6 Watersheds (Upper Buchorn, Middle Buckhorn and Redstone). These watersheds drain generally east and south to Buckhorn Creek and, ultimately, Big Thomson River.

N. Total Acres Burned: 87,487.
NFS Acres(42,634) Other Federal (261) State (5,022) Private (39,570)

Map of soil burn severity by ownership is provided in Section III of this report (below)

O. Vegetation Types: Predominantly mature lodgepole pine, relatively closed canopy. At lower elevations, mixed-conifer forests containing lodgepole pine, ponderosa pine, and Douglas-fir. Upper elevations consist of forests transitioning to Engelmann spruce and subalpine fir. Pockets of aspen exist throughout forested areas and in minor drainage-ways. Limber pine on some ridgelines. Non-forested openings are primarily grass, grass-forb complexes, mountain mahogany, bitterbrush, sagebrush, and other upland shrubs. Major drainages with riparian areas are dominated by graminoids and willows, with alders, Rocky Mtn. maple, and other common riparian vegetation. Steep rocky south- or west-facing hillsides/canyons of lower elevations with open junipers, ponderosa pine, shrubs and bunchgrasses; steep rocky north- or east-facing hillsides/canyons with bunchgrasses, shrubs, and mixed-conifer forests dominated by Douglas-fir.

P. Dominant Soils: There are 56 soil units inside the High Park fire perimeter. Dominant soils inside the fire perimeter are divided into three soil series which comprise 13% to 25% of the area. These soil series are Wetmore-Boyle-Rock outcrop complex, 5 to 60 percent slopes, Haploborolls-Rock outcrop complex, steep, and Redfeather sandy loam, 5 to 50 percent slopes. These 3 units represent a total of 52% of the burned

area. The Haploborolls-Rock outcrop complex and Redfeather sandy loam units are located mostly in moderate soil burn severity areas. The Wetmore-Boyle-Rock outcrop complex is the dominant soil unit inside high burn severity areas.

These soil units have up to 35% rock fragment content and are classified as stony and gravelly. Surface textures are mostly sandy loam. Rock outcrops are common throughout the burned area. Dominant rock outcrops are present on steeper slopes of 60% or greater.

Q. Geologic Types: There are six main geologic formations in the burned area: two igneous, two metamorphic, and two sedimentary. The igneous formation of granitic rock material covers 19 percent of the area. The metamorphic formations are biotitic and felsic gneiss with schist, and cover approximately 79% of the area. The sedimentary formations are sandstones and limestones. The sedimentary formations cover approximately 1% of the burned area. Large granite inclusions occur in the south-central area of the burn. Metamorphic rocks (biotitic gneiss and felsic gneiss) occur as a continuous unit inside the perimeter with small inclusions of felsic gneiss formation.

R. Miles of Stream Channels by Order or Class: 57 Perrenial, 271 Intermittent, 316 Ephemeral

S. Transportation System: Trails: 9 miles Roads: 40.6 miles of system and non-system roads were assessed

PART III - WATERSHED CONDITION

A. Burn Severity (acres): 14,072(unburned) 32,302 (low) 35,399 (moderate) 5,714(high)

A BARC image was obtained on 06/18/2012. Approximately 50,000 acres was covered by the 06/18 image. Additional BARC coverage was requested but, due to cloud cover, additional imagery was not available. The BAER Team mapped the remaining acreage by aerial and ground reconnaisance of the burned area. Soil burn severity observations and mapping were based on criteria outlined in the Field Guide for Mapping Post Fire Soil Burn Severity. An additional 7,685 acres (The Hewlett Fire) was recently burned in May, 2012. The High Park Fire burned to the western and southern flanks of the Hewlett Fire. The cumulative effect of increased peak flows and sediment laden flows from both burned areas increases the risk for various downstream values at risk, particularly effects on drinking and irrigation water providers.

B. Water-Repellent Soil (acres): 12,238. (Water repellency was observed in the field under moderate and high soil burn severity in shrub and forest vegetation types. It was estimated that 30% of the high and moderate severity burn is water repellent.)

C. Soil Erosion Hazard Rating (acres): 7,867 (low) 30,009 (moderate) 48,798 (high)

D. Erosion Potential: Erosion potential increased from 1 ton/acre pre-fire to 23 tons/acre post-fire (estimation based on soil burn severity, slopes and ERMiT runs).

The ERMiT model was used to determine the expected rates of erosion from burned and unburned hill-slopes within the burned area. ERMiT runs for a variety of slopes, vegetation types and burn severities within the burned area are outlined in the High Park BAER Soil Resources Report.

Eighteen scenarios were selected geographically by ownership (US Forest Service land, private, state and/or county), burn severity (high, moderate, low), and cover (forest, grassland, shrubland). Slope gradients and hillslope length were determined for each scenario using Geographic Information system (GIS). Rock content and surface texture was obtained from the soil survey. The data were then entered into ERMiT to obtain the amount of sediment delivery expected from unburned (pre-fire) and burned areas (post-fire).

Erosion Potential from U.S. Forest Service land ranged from less than 1 ton/acre pre-fire to 23 tons/acre post-fire. This estimate was based on soil burn severity, slopes and ERMiT runs as shown below:

ERMiT inputs:

Soil Burn Severity/ Vegetation type	Scenario #	Hillslope Horizontal Length (ft)	slope % top	slope % middle	slope % toe	Texture	Rock content %
High/forest	1	700	60	30	10	extremely cobbly loamy sand	35
High/rangeland	2	700	30	10	10	very gravelly coarse sandy loam	35
High/shrubland	3	500	30	20	10	very gravelly coarse sandy loam	35
Moderate/forest	4	1000	0	40	20	coarse sandy loam	35
Moderate/ rangeland	5	900	60	30	10	very gravelly coarse sandy loam	35
Moderate/ shrubland	6	400	40	20	10	sandy loam	35
Low/forest	7	400	40	20	10	very cobbly sandy loam	35
Low/rangeland	8	100	30	10	0	coarse sandy loam	5
Low/shrubland	9	600	40	20	10	extremely cobbly loamy sand	15

ERMiT outputs:

Soil Burn Severity/ Vegetation type	Scenario #	Sediment delivery (tons/acres) pre-fire	Sediment delivery (tons/acre) post-fire
High/ Forest	1	1.4	15.91
High /Rangeland	2	0.42	4.9
High/Shrubland	3	0.7	14.84
Moderate/Forest	4	2.19	19.69
Moderate/Rangeland	5	1.65	22.9
Moderate/Shrubland	6	0.65	10.95
Low/Forest	7	0.88	4.95
Low/Rangeland	8	0.14	0.63
Low/Shrubland	9	3.75	9.84

E. Sediment Potential: 1,090 cubic yards / square mile

PART IV - HYDROLOGIC DESIGN FACTORS

A. Estimated Vegetative Recovery Period, (years): 3-5 years (recovery of hill-slope stability)

B. Design Chance of Success, (percent): 80% (assuming damaging storm does not occur before treatments are in place)

C. Equivalent Design Recurrence Interval, (years): 10

D. Design Storm Duration, (hours): 1

E. Design Storm Magnitude, (inches): 1.5

F. Design Flow, (cubic feet / second/ square mile): 70
G. Estimated Reduction in Infiltration, (percent): 55
H. Adjusted Design Flow, (cfs per square mile): 180

Percent Flow Increase by Watershed (Wildcat Model)

Watershed Number	Watershed Name	Percent USFS land	Prefire Estimated Discharge (cfs)	Postfire Estimated Discharge (cfs)	% of pre-fire flow
101900070209	Bennett Creek	98	114	210	184%
10190006061602	Blackhurst Gulch	0	139	501	360%
10190007141012	Boyd Gulch	0	95	468	493%
10190007140610	Buck Gulch	100	51	206	404%
101900060614B4	Buckhorn D	0	197	495	252%
10190007140608	Cedar Gulch	82	92	402	437%
101900071812DG	Devil Gulch	0	134	385	287%
101900071812EG	Empire	0	73.7	183	249%
10190007141004	Falls Gulch	98	93	470	505%
101900070304	Hewlett Gulch	48	408	747	183%
10190007141008	Hill Gulch	18	226	1094	484%
101900071812AG	Labeau Gulch	0	148	383	259%
101900071812OG	Long Brown Gulch	0	176	844	479%
10190006061606	Lower Laurence	0	85	213	251%
10190007180604	Lower Lewstone	0	214	1063	497%
10190007031006	Lower South Fork	100	45	135	301%
10190007180604	Middle Lewstone	0	49	154	314%
10190006060206	Monument Gulch	88	50.1	153	305%
10190006060224	Paradise Park	38	99.1	394	397%
10190006060210	Pendergrass A	92	33.3	85	255%
10190007031004	Pendergrass B	100	39	285	731%
10190007031004	Pendergrass C	100	26	1090	4194%
10190007031004	Pendergrass D	87	29	82	284%
10190007180602	Poudre 1A	0	137	730	533%
10190007180602	Poudre 1C	0	128	460	360%
10190007140602	Poverty Gulch	94	136	796	585%
10190006061604	Raspberry Gulch	0	181	494	273%
10190006061610	Redstone Creek A	0	101	562	556%
10190006061610	Redstone Creek B	0	80	501	626%
10190006061610	Redstone Creek C	0	74	257	348%
10190006061610	Redstone Creek D	0	47	58	124%
10190006061610	Redstone Creek E	0	95	127	133%
10190007180606	Rist A	.35	108	691	640%
10190007180606	Rist B	0	89	389	437%
10190007180606	Rist C	0	98	411	419%
10190007180606	Rist D	0	128	716	560%

10190007180606	Rist E	0	53	235	443%
101900071818H1	Santanka Gulch	0	41.5	56	135%
10190007140604	Skin Gulch	89	182	884	486%
101900071818H2	Soldier Canyon	0	92.2	171	185%
10190007140606	Stevens Gulch	50	81	269	332%
10190006060402	Stove Prairie A and B		241	829	344%
10190007031008	Trib to South Fork	80	49	717	1464%
10190007180602	Tunnel	0	139	442	318%
10190006060222	Twin Cabin Gulch	85	63.6	242	381%
101900071818H3	Unnamed 1--	0	30	50	168%
10190007180602	Unnamed 2	0	72.5	389	536%
10190007141014	Unnamed 3	1	40	213	531%
10190007141014	Unnamed 4	0	32	86	270%
10190007141014	Unnamed 6	39	35	77	221%
10190007141002	Unnamed 9	85	96	380	396%
10190006061606	Upper Laurence	0	168	473	281%
10190007180604	Upper Lewstone	13	96	242	252%
10190007031006	Upper South Fork	89	226	1068	473%
101900071818H4	Well Gulch	0	68.6	80	116%
10190006060216	White Pine A	96	30.6	69	226%
10190006060214	White Pine B	83	21.6	35	160%
101900070303	Young Gulch A	58	121	511	422%
101900070303	Young Gulch B	21	166	558	336%
101900070303	Young Gulch C	0	56	138	246%
101900070303	Young Gulch D	63	96	369	384%
101900070303	Young Gulch E	19	143	724	506%
101900070303	Young Gulch F	77	69	195	283%

PART V - SUMMARY OF ANALYSIS

A. Describe Critical Values/Resources and Threats:

HUMAN LIFE/SAFETY and PROPERTY

Threats to life and safety and property exist in valley bottom areas and in steep burned gulches throughout and downsream from the burned area. Residents and road users will be exposed to increased risk of flooding and debris flow. Houses and other structures, driveways, other private property, Forest Service recreation facilities, and roads and trails located in valley bottoms adjacent to or in the floodprone areas or near stream channels and are at increased risk for flooding and debris flow. In several locations, structures and roads are located on alluvial and debris flow fans at the outlets of severely burned gulches and are at increased risk for debris flows. Water diversion infrastructure is at risk due to sediment and debris accumulation. Numerous ponds and small reservoirs within the burned area are at increased risk of filling with sediment and/or dam failure.

Roads

There are State, private, County and Forest Service roads within the burned area. There are seventeen total Forest Service roads that lie within the fire perimeter; three of these roads travel through Low and Unburned severity and require no treatment. Listed below are the seven roads that travel through Moderate and High burn severity where impacts are likely.

- NFSR 100
- NFSR 127.A
- NFSR 135
- NFSR 152
- NFSR 152.C
- NFSR 339
- NFSR 343

Roads within the burned area are at risk from impacts from increased water, sediment, and/or debris. Impacts include damage to the road and/or loss of access due to severe erosion of the road surface, or deposition of sediment or debris. Increased risk for temporary loss of access/egress exists on major throughfares and on un-paved roads within the burned area. Any damage to, or blocking of, State Highway 14, the county road network, Forest Service Roads and/or private roads, could eliminate access to residents or emergency service providers. Roads within the burned area are also likely to exacerbate the risk of flooding and erosion by collecting surface water, concentrating it and delivering it to hillslopes or stream channels. Most of the roads within the burned area have inadequate cross-drainage for anticipated post wildfire flows.

1. Resource condition resulting from the fire

    a. Severely burned slopes and drainages exist above 14 roads in several locations. These burned drainages present increased hazards to road infrastructure and life and safety from debris and sediment flows.
    b. In several locations the road is becoming the path of flow and sedimentation has started to occur. It is estimated that 85 Rolling Dips, Lead Outs and Ditches should be installed along 7 roads to help impede the flow of ash laden runoff and sedimentation.
    c. All culverts are undersized for the flows anticipated. Culverts will be removed and replaced with hardened crossings until vegetation has returned to the drainage. We found a total of 23 culverts that will need to be replaced. The team determined that 12 culverts will need to replaced immediately, the remaining 11 will be removed and then replaced one or two years after removal (pending vegetation response).
    d. Road treatments will be needed for a total of 24.63 miles on a total of 7 roads to protect the road

surface and road drainage structures from damage caused by increased post wildfire runoff and erosion.

e. To help protect several watersheds, it was determined to close the road (remove culverts to protect human life and safety and water quality.
f. Removal of severely burned and/or structurally compromised trees will be needed to protect the life and safety of Forest Service workers implementing road stabilization treatments.

An emergency for roads was determined for Human Life and Safety and Property. The probability of loss is Very Likely and the magnitude of consequence is Major. Therefore, the BAER risk is Very High.

Recreation Resources

A. Mountain Park Campground's location at the base of the steep, burned hillside create a high probability that 5 campsites closest to the burned area will be susceptible to debris flow and minor flooding. A minor flow (several inches in depth) did occur into one of these sites after a major rain event on 7/6/12.

B. The culvert located under Highway 14 at Stove Prairie Campground creates a moderate likelihood that flooding/debris from high rain fall onto the burned hillside across from the campground will be deposited onto the campground's access road and have to be removed.

C. Ansel Watrous Campground has been determined to be intermediate risk, since the wide and fairly deep creek bed can likely handle major rain runoff. This was evidenced during a heavy rain event since the fire's containment date.

D. Similar to Stove Prairie Campground, the culvert at located under Highway 14 at Diamond Rock Picnic Area poses a moderate probability that flooding/debris from high rain fall onto the burned hillside across from the picnic area will flow through the culvert and splash directly onto picnickers sitting at a table in a direct path with the culvert. The picnic area predates the culvert.

E. The looped Mount McConnel and Kreutzer Trails, Hewlett Trail, and Young Gulch Trail all sustained burn severity that has reduced tree and ground cover to the point that debris flows are already occurring along much of their lengths. The Young Gulch trail is at greatest risk. Hazard trees are also an issue on all these trails.

F. There is a high probability that recreation residences that have been constructed over or near creeks at the mouths of drainages will be susceptible to life-threatening flooding and debris flows. These locations include cabins in the Lower Bennett, Narrows, and Poudre Park summer group residences. One structure at the Narrows has already been destroyed by a debris flow.

G. The fireline created in the Narrows area has created an access point for unauthorized OHV use onto highly erodible soils. This may create an additional debris flow hazard for Highway 14 and increase vegetation destruction and run-off.

H. Recreational fishing and scenic viewing along the South Fork Poudre River has been greatly impacted by the fire. Biologists have determined that sedimentation and run-off from the fire will stress the river environment for the next several years.

An emergency for recreation (trails, recreation sites, and recreation residences) was determined for Human Life and Safety and Property. The probability of loss is Very Likely and the magnitude of consequence is Major. Therefore, the BAER risk is Very High.

Water Diversion Infrastructure:

Three municipal water supply diversion lie within the burn perimeter. These diversions provide water for the City of Fort Collins, the City of Greeley, and the Tri-Districts (three drinking water providers who jointly operate the Soldier Canyon Water Treatment facility). These facilities are at increased risk of damage due

to debris and sediment accumulating at the intakes.

The eastern perimeter of the fire is bounded by Horsetooth Reservoir, the largest east-slope reservoir of the Colorado-Big Thompson Project, and the Hanson Supply Canal, which delivers Horsetooth Reservoir to the Cache La Poudre River. While these facilities are also at increased risk from post-fire runoff and sedimentation, watershed which affect the facilities are located entirely on non-NFS lands

An emergency for water diversion infrastructure for the facilities on the Cache La Poudre River was determined for Property. The probability of loss is Likely and the magnitude of consequence is Moderate. Therefore, the BAER risk is High.

NATURAL RESOURCES

Water Quality Degradation:
Soil erosion and subsequent large sediment increases are predicted throughout and downstream of the burn area. An emergency for water quality degradation **was** determined for the following reasons:

- Large sediment increases are expected. These increases will be of short term duration, recovering to pre-fire conditions over time with the worst impacts occurring over the next three years. During this time there is high potential for degradation of source water quality for the city of Fort Collins, the City of Greeley, and the Tri-Districts (North Weld, East Larimer-Fort Collins) which all utilize water from the Poudre River. There will likely be significant impacts to public water supplies due to sediment increases and reduced water quality. All of these water providers also use Horsetooth Reservoir as an alternate water supply to the Poudre River. The fire has also affected the area that drains directly into Horsetooth.

The probability of loss is Very Likely and the magnitude of consequence is Major. Therefore, the BAER risk is High.

Flood Hazard:
The flood hazard is predicted to increase dramatically within and immediately downstream of the burn area. An emergency for flood hazard **was** determined for the following reasons:

- Runoff is predicted to increase significantly following the fire.
- There are a high number of residents and recreationists in the area resulting in high numbers of people exposed.
- High traffic roads with drainage structures including Colorado Highway 14.
- There is substantial risk to life and property resulting from the increased flood risk.

The probability of loss is Very Likely and the magnitude of consequence is Major. Therefore, the BAER risk is High.

Debris Flow Hazard:
The debris flow hazard is expected to increase significantly in the years following the fire. An emergency for debris flows **was** determined for the following reasons:

- There are a high number residents and recreationists in the area resulting in high numbers of people exposed.
- The infrastructure in the area in not adequate to handle the increases in flow and sediment predicted.
- Debris across the roads in the area could result in large numbers of people being cut off from emergency services, possibly for long periods of time.
- There is substantial risk to life and property resulting from the increased debris flow risk.

The probability of loss is Very Likely and the magnitude of consequence is Major. Therefore, the

BAER risk is High.

Road Washout Hazard:
The road wash out hazard is expected to increase significantly in the near future. An emergency for roads washing out **was** determined for the following reasons:

- There is substantial risk to life and property resulting from the increased debris flow risk.
- The current transportation system is not expected to handle the predicted flood flow increases and sediment loads.
- Roads washing out in the area could result in large numbers of people being cut off from emergency services, possibly for long periods of time.

Native or Naturalized Plant Communities
There are no known occurrences of Threatened or Endangered (TE) plants in or near the burn area, and no undetected occurrences are suspected. Overall, there are no anticiapted threats to TE plant species due to possible erosion, sedimentation, or other fire- or fire-suppression related impacts with the possible exception of the canal-side site of Ute ladies-tresses on non-federal land.

Multiple sites of several sensitive plants and species of local concern are known to occur in the burn area. Most sites occur in rocky areas or ridges, and some plants are anticipated to have burned during the fire or to be adversely impacted by habitat alteration in the short-term. It is probable that many plants survived, and that most sites would not experience long-term reduced viability with return to pre-burn conditions, including return of pollinators. None were impacted by fire suppression activities.

No Emergency was determined.

Range and Weeds.
Several areas with known weed infestations were noted in the field: Young Gulch Trail (several species including leafy spurge burned at moderate to high soil burn severities), the area at CR27 and Highway 14 (several species including leafy spurge burned at light soil burn severity), riparian meadows near Fish Creek trailhead (yellow toadflax burned at patchy light soil burn severity to no burn), campgrounds along Highway 14 (unburned). On the Hewlett Fire, the fire did not burn the west side of the Hewlett Gulch trail. The High Park Fire took care of this and the entire trail is burned mostly at light soil burn severity.

In the Swan Range Allotment, the burn was variable, but the West pasture appeared to be more moderately burned than the Middle pasture. The spring developments sustained light damage and the fences sustained moderate to heavy damage. In the Bennett Creek Allotment, the burned area east of Pingree Park Road occurs in steep and timbered terrain generally not grazed by livestock; therefore, most of the utilizable rangeland occurring on the rest of the allotment was unaffected. The Camman Spring survived. No emergency structural or management measures are needed on either allotment to protect recovering areas from grazing. Timing and intensity of grazing in 2013 will be monitored and addressed through the grazing permit administration process.

Emergency Determination: **There is an emergency situation for the recovery of native vegetation due to significant threats from noxious weed establishment and/or spread affecting natural plant community integrity, wildlife habitats, and watershed values.** It is likely that existing weed infestations will increase, particularly in moderate to high soil burn severity areas, due to conditions favorable to accelerated growth and reproduction, and release from competition with native plant communities. In addition, the unintentional introduction and dispersal of invasive weeds into areas disturbed by fire suppression and rehabilitation has the potential to establish persistent weed populations. It is expected that most native vegetation will recover if weed invasions are minimized.

Wildlife: Critical Habitat or Suitable Occupied Habitat
The fire appears to have resulted in minor consequences to Preble's critical habitat and other suitable Preble's habitat. As described above, the majority of riparian vegetation within Preble's habitat appears to have been unburned or lightly burned by the fire. Additionally, where riparian herbaceous or shrub

vegetation was moderately burned or killed, this vegetation should grow back within about 1 to 3 years approximately. This also should be the case for herbaceous and shrub vegetation in the adjacent upland Preble's habitat zone as well. Some riparian vegetation may be covered by ash and sediment during flood events, but this would be a fairly temporary condition not resulting in long-term impacts to Preble's habitat.

For the mapped lynx habitat, the majority of this forest area was killed by crown fire. This forest habitat will take a few to several decades to grow back to a condition where it may provide suitable lynx habitat. However, as noted above, it's questionable how much of this area actually provided suitable lynx habitat because it is likely that much of it was dry lodgepole pine or single-story lodgepole that lacked dense horizontal cover, which is a key component for lynx habitat. Also, the polygon of mapped lynx habitat was isolated by lower elevation unsuitable habitat from the main body of both the Poudre and Estes LAUs. Crown fire in this type of ecosystem is a natural disturbance process that ultimately provides different age classes of forest for lynx habitat.

Emergency Determination **– Based on the discussion presented above, it is determined that there is no emergency for either Preble's or lynx habitat within the High Park Fire area.**

Fisheries.
The streams that will see potential adverse impacts from post fire run-off events associated with thunderstorm and overland flow events identified during the BAER process were: mainstem Cache La Poudre River, South Fork Cache La Poudre River, Buckhorn Creek, Bennett Creek, and Young Gulch. We anticipate adverse post-fire effects to alter aquatic habitats and disrupt aquatic life for three to five years. Recovery of aquatic ecosystems will occur as erosion rates diminish and flushing flows route fire contrived fine sediment from main channels.

Emergency Determination: Because there are no fish that are threatened or endangered found in the area within the fire boundary or directly downstream that would experience adverse post fire effects, there is not emergency determination for fisheries. Similarly, as the Arapaho Snowfly is only a species under consideration for listing and not an officially listed species, there is not an emergency determination. However, to limit impacts to aquatic habitat and organisms we strongly recommend that upland treatments in the watershed address overland flow erosion, that trail reconstruction to Young Gulch be completed in accordance with Region 2 Soil and Water Conservation Practices, and that all road reconstruction and maintenance be completed in accordance with Region 2 Soil and Water Conservation Practices and specifically address and limit stream sedimentation.

CULTURAL AND HERITAGE RESOURCES

The High Park Fire is located in steep terrain with relatively few known cultural resources. Those that are known are clustered around the drainages on the perimeter of the fire area. Three values at risk (resources rated at high or very high risk) were identified: 5LR1381, a prehistoric plains woodland period open camp; 5LR13065, a WWII plane crash site; and 5LR11051, a historic recreation residence. 5LR1381 is at risk damage from debris flows and erosion events stabilization or data recovery are recommended. 5LR13065 is at risk or erosion and is in an area proposed by other resources for aerial mulching. 5LR11051 is at risk of for erosion that could cause damage to cultural resources, substantial property damage and possibly loss of life or injury to humans.

In addition, undiscovered NRHP-eligible cultural resources may exist in the area of potential effects associated with BAER-related activities such as construction of water bars, trail work, or other ground-disturbing activities. The National Historic Preservation Act requires a cultural resource inventory and consultation with the State Historic Preservation Office (SHPO) prior to implementation of these activities.

The probability that post wildfire runoff from typical high intensity/short duration summer thunderstorms could impact cultural and heritage resources is possible and, if impacted, the consequenses would be major. **The BAER risk for impacts to these resources is considered to be high.**

Summary of BAER Risk Assesment

Threat Identification	Critical Value	Probability of Loss	Magnitude of Consequences	BAER Risk
Roads	Life and Safety/Property	Very Likely	Major	Very High
Trails and Recreation	Life and Safety/Property	Very Likely	Major	Very High
Water Diversion Infrastructure	Property	Likely	Moderate	High
Water Quality Degradation	Nat. Resources (Water Suppy)	Very Likely	Major	Very High
Flood Hazard	Natural Resources	Very Likely	Major	High
Debris Flow Hazard	Natural Resources	Very Likely	Major	High
Invasive Species	Natural Resources	Likely	Moderate	High
Cultural Resources	Cultural Resources	Possible	Major	High

B. Emergency Treatment Objectives:

Land Treatments

The objective of aerial mulching is to reduce hill-slope erosion and associated flooding, sediment laden flows and/or debris flows within the burned area.
This treatment is recommended to:

- Lower the risk of post wildfire impacts to life/safety of residents, road users and recreational users
- Lower the risk of post wildfire impacts to private property, roads and water supply infrastructure
- Lower the risk of post wildfire impacts to public drinking water quality

The objective of noxious weed detection surveys and treatments is to provide for recovery of native vegetation by preventing the establishment and spread of noxious weeds in the recently burned area.

Road and Trail Treatments

The objective of road and trail stabilization treatments is to lower the risk of damage to property (system trails) by lowering erosion of the trail surface in severely burned and steep areas within the burned area and to provide for public safety. The objective of temporary closure of roads is to reduce risk to human life and safety.

Protection/Safety Treatments

The objective of the hazardous tree removal treatment is to lower threat of hazardous trees to the life/safety of workers implementing BAER trail stabilization and storm patrol treatments on the Mount McConnel, Kreutzer, Hewlett, and Young Gulch Trails.

The objective of installing warning signs is to reduce threats to life/safety of recreational hikers by warning that they are entering a burned area and warning against access into hazardous areas adjacent to the trails. These signs also serve too accelerate natural recovery by preventing travel off trails. Additional signs to provide warning of increased potential for falling rock and debris are also recommended to lower threats to human life/safety at specific locations along trails within the burned area.

The objective of temporary closure of trails is to reduce risk to human life and safety.

Another important objective of the BAER Team is to communicate the findings of this report to the National Weather Service, the Larimer County Office of Emergency Services and the local Fire Protection Districts. The purpose of this communication would be to inform these entities of anticipated post wildfire watershed

response and associated threats to public safety. This information could be utilized in the development of early warning systems or emergency response plans.

Cultural Resources

The objective of cultural resource treatments is to prevent irretrievable loss of archeological information, to prevent looting by informing recreational users of the importance of archaeology and federal laws that prohibit theft of artifacts and damage to historic or prehistoric sites, to prevent erosion on disturbance of archaeological materials,and to divert runoff that is adversely affecting the foundation of a recreation residence.

C. Probability of Completing Treatment Prior to Damaging Storm or Event:

Land 80 % Channel ___ % Roads/Trails 80 % Protection/Safety 80 %

D. Probability of Treatment Success

	Years after Treatment		
	1	3	5
Land	90	90	100
Channel			
Roads/Trails	90	90	100
Protection/Safety	90	90	100

Summary of VARTool Calculations:

- Market Resource Values (direct losses and loss of use): $9,100,000
- Cost of Treatment: $7,246,699
- Expected benefit of treatment $8,190,000
- Benefit/cost ratio=1.1

The VARTool Calculation Spreadsheet is available in project file. As described in this report, increased risk for impacts to life/safety and non-market cultural and ecological values exists throughout the burned area. These values were decribed in the VAR Assessment but not considered in the benefit/cost ratio.

G. Skills Represented on Burned-Area Survey Team:

[x] Hydrology	[x] Soils	[ ] Geology	[X] Range
[ ] Forestry	[x] Wildlife	[ ] Fire Mgmt.	[X] Engineering
[ ] Contracting	[ ] Ecology	[x] Botany	[X] Archaeology
[x] Fisheries	[ ] Research	[ ] Landscape Arch	[X] GIS

USFS Team Leader: Eric Schroder. Email: eschroder@fs.fed.us. Phone: 303 541 2538
NRCS and Larimer County Team Leader: Todd Boldt (NRCS) and Mark Petersen (Larimer County)

Because the fire burned both NFS and non-federal lands, a multi-agency team was assembled to conduct the burned area assesment. Personnel from the Forest Service, the Natural Resource Conservation Service, Larmer County, and the Colorado Departmetn of Transportation were represented on the team. The BAER process of evaluating burned area conditions, critical values at risk, threats, risk and treatments was employed. Inter-disciplinary and inter-agency coordination occurred throughout the process.

Forest Service BAER Team Members

Forest ServiceTeam Lead	Eric Schroder
Soils	Lizandra Nieves-Rivera
Hydrology	Deb Entwistle/Liz Schnackenberg/Jamie Krezloc
Hydrology/Affected Interest Liason	Carl Chambers
NoxiousWeeds/Botany	Kim Obele/Steve Popovich
Engineering	Kipp Klein/Judy Kittson/Steve Wood
Recreation	Kristi Wumkes
Wildlife	Dale Oberlag
Fisheries	Chris Carroll
Cultural Resources	Larry Fullencamp
GIS	Janice Naylor/Amy Coe
Public Information	Tammy Williams/Reghan Cloudman

NRCS Team Members

NRCS TeamLead	Todd Boldt
Soil Scientist	John Norman
Soil Scientist	Chris Fabien
Range	John Fusaro
Public Information	Petra Barnes-Walker
Engineering	Andy Piszkin

Larimer County Team Members

Larimer County Team Lead	Mark Peterson
Engineer	Todd Jergens
GIS	Jeff Rulli
Weeds	Tim D'Amato
Public Information	Deni LaRue

CDOT Team Members

CDOT Engineer	Scott Ellis

External Partners and Contacts

Lisa Voytko	City of Fort Collins
Eric Reckentine	City of Greeley
Rodney Hansen	Tri-District/Soldier Canyon Filter Plant
Roger Sinden	Northern Colorado Water Conservancy District
Boulder County Plant Ecologist	Claire DeLeo
Greg Sundstrom	CO State Forest Service

H. **Treatment Narrative:**

(Describe the emergency treatments, where and how they will be applied, and what they are intended to do. This information helps to determine qualifying treatments for the appropriate funding authorities. For seeding treatments, include species, application rates and species selection rationale.)

Land Treatments:

Aerial Mulching

Aerial application of 5,597 acres of mulch on NFS lands to provide groundcover replacement is recommended. Approximately 90% of the treatment acres (5,037ac.) would be mulched with weed-free agricultural straw. The remaining 10% of the area (560 ac.) would be mulched with wood shreds. Wood shreds would be used in locations such as ridge tops, where winds would likely blow away

straw. Mulching treatments are located to address threats to values at risk such as human life and safety, property (primarily homes and roads) and public water supply.

At the time of this report, the NRCS is developing a proposal for the same treatment on non-federal lands. When the NRCS obtains a local sponsor and EWP funds are available for treatment on private lands, we will submit an interim report to display those treatments.

Criteria for treatment polygon locations includes one or more of the following:

- High and moderate soil burn severity, on slopes between 20% and 60%
- Watersheds tributary to the Cache la Poudre River and from which increased hill-slope erosion and sediment delivery to the Cache la Poudre River is highly probable in the first year following the fire (based on soil erosion modeling, hydrologic modeling, map review and field review); or where life and safety or property are at risk.
- Watershed not tributary to the Cache la Poudre where local life and safety or property are at risk

Generally, these treatment polygons are located where dense to moderately dense stands of conifers were burned and where soil burn severity was mapped as high or moderate due to consumption of most, if not all, of the litter/duff forest floor. Due to removal of ground cover and heat impacts on the soil, these once stable hill-slopes are now highly susceptible to erosion. Generally, the precipitation events of highest concern are high intensity summer thundershowers. Erosion control materials that would meet treatment objectives include certified weed free agricultural straw and/or other effective erosion control materials such as wood shreds. The recommended application rate for straw mulch is 1.0 tons/acre. The recommended application rate for wood shreds is 6 tons/acre. Based on recent monitoring of aerial application of mulch on another local fire (Fourmile Fire in Boulder County), treatments are likely to be effective in this geographic location. As shown in the Soil Scientist's Specialist Report, ERMiT runs for typical treatment areas show significant reduction in probability of hill-slope erosion if mulching treatments are applied.

Noxious Weed Detection and Treatment

Treatment Description: (to be implemented partially with force account and partially with Larimer County crews through a Participating Agreement on NFS lands). Based on 2012 detection surveys, additional funding was approved for this agreement in 2013.

Conduct weed detection surveys. Prioritize areas where heavy fire suppression activity occurred, such as bulldozer lines, helispots/heliports, spike camps, equipment cleaning sites, and staging areas. Also, areas of moderate to high soil burn severity, particularly those areas proximal to known infestations and heavy suppression activity. The entire burn area should be monitored for possible introduction of invasive species inadvertently brought in on fire suppression equipment and vehicles from outside Larimer County. Additionally, monitoring should occur at sites treated with straw mulch for erosion control. Despite the awareness and active efforts to prevent weed spread by introduction of seed or vegetative propagules, the problem is often documented in areas following wildfire. Monitoring needs to occur following the first precipitation event, and continue throughout the subsequent growing season.

- **Treat infestations from detection surveys.** Focus on three priority species: leafy spurge (*Euphorbia esula*), diffuse knapweed (*Centaurea diffusa*), and spotted knapweed (*Centaurea maculosa*); and any new high priority species brought in from outside of Larimer County.

Channel Treatments:

No channel treatments are proposed on USFS lands.

Roads and Trail Treatments:

A determination was made that BAER treatments are needed on nearly all system and non-system

roads within the burned area. The following treatments were identified as BAER road treatments for the High Park Fire burned area:

1. Temporary road closures are recommended for NFSR 100 and NFSR 152 to protect public safety.
2. Road stabilization with Rolling Dips, Lead Outs and Ditches
3. Treatment of Hazard Trees and Unstable Rocks to protect workers implementing BAER treatments
4. Erosion control on steep side slopes above or adjacent to roads by aerial mulching, aerial mulching is addressed above.
5. Removal of culverts on all roads and replaced with hardened
6. Replacement of culverts when drainage/vegetation has been restored
7. Storm Inspection and Response on roads to remain open

Trails and Recreation Facilities:

Mountain Park Campground: Restrict use of host site and sites 1-5, 17, 20, 23 until slope stabilizes, by removing them from the reservation website. Inform campers that non-life threatening debris flows may occur around site 32. Have hosts monitor rain events and debris flows. Post signs at campground: *In case of flash flood climb to safety*.

Culverts at Stove Prairie Campground and Diamond Rock Picnic Area: Remove hazard trees above culvert at Diamond Rock to provide for crew safety, and install large diameter rock riprap in area below outlet of culvert to dissipate water flow energy. Install caution sign at picnic table below culvert.

Trails: Keep all trails closed to ensure public safety until trail stabilization can be implemented or conditions stabilize. Remove hazard trees to ensure crew safety during construction of trail stabilization features. Post "*entering burn area/stay on trail*" and flood warning signs at trailheads. Provide outsloping where possible. Provide additional cross-drainage on trails. Where feasible, utilize volunteer community crews to assist with trail stabilization and rehabilitation.

Close the Young Gulch Trail for the year due to slope instability/high flooding potential in this large watershed. Install a gate at the trailhead to keep vehicles out of the parking area. Install closure signs. Monitor trail for conditions after major rain events, and after the spring thaw.

Close the east side of the Mount McConnel Trail until trail stabilization features can mitigate safety concerns.

Stabilize the eroded portion of the Kreutzer Trail to prevent continued incision on the eastern portion of the trail before allowing public use.

All recreation residence owners have been notified of the conditions and risks associated with the locations of their summer-use cabins. Engineering inspections for building stability will be recommended to residence owners after facility assessments by the Forest Service.

Install protective barriers along the Narrows fireline section to prevent OHV trespass and increasing erosion.

Implement closure order to prohibit recreational use along the Wild River portions of the South Fork of the Poudre, to allow this specially-designated corridor time for natural restoration. Provide monitoring and enforcement of the closure order.

Cultural Resources:

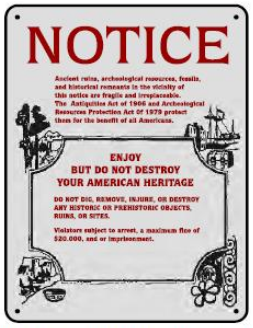
Treatment Types:

5LR11051 – Installation of Log Deflectors
5LR13049 – Sign Installation
5LR13065 – Aerial Mulching (coordinated treatment)
5LR1382.1 – Trail Stabilization (coordinated treatment)

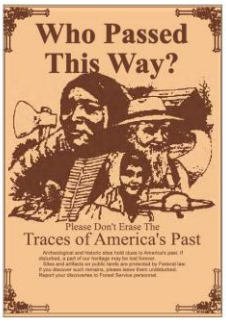
Treatment Descriptions:

5LR11051 – Log Deflector Installation: the proposed treatment for protection of site the Lower Bennett Creek Recreation residence would utilize the BAER catalog Log deflector treatment (Napper 2006:77). The treatment would place log deflectors around site 5LR11051 to change the runoff's direction without erosion by simulating a new channel area. The treatment would place 6 to 9 inch diameter logs at a 120 degree angle from the diversion point and construct a shallow trench to divert runoff.

5LR13049 – Sign Installation: the proposed treatment for the prevention of looting at the Cyril and Mayme Spaulding Homestead consists of installation of education signs on posts near the site. The proposal would use Forest Service signs that educate recreational users about cultural resource laws and the value of cultural resources:



Reddish brown on light gray, (27-7). 11" x 14"



P2346 12" x 16"
Brown on tan.

(Unicor 2011)

In addition to the specific treatments that are being proposed for cultural resources aerial mulching treatments that have been proposed for other resource areas would benefit the cultural resources at risk as well by reducing the probability and severity of flooding or debris flows.

I. **Monitoring Narrative:**

(Describe the monitoring needs, what treatments will be monitored, how they will be monitored, and when monitoring will occur. A detailed monitoring plan must be submitted as a separate document to the Regional BAER coordinator.)

Aerial Mulching Treatment Implementation and Effectiveness Monitoring
Monitoring of effectiveness of the aerial mulching treatment following precipitation events is recommended. This monitoring will also serve to determine if treatment in year two following the fire would be necessary. Monitoring would be conducted by ARNF-PNG Soil Scientists and/or Hydrologists. We estimate that this would take five trips with two people (10 person days) over the course of the year.

Closure Implementation and Effectiveness Monitoring
Several trails and recreational facilities along the Cache La Poudre River corridor are recommended for temporary closure. We estimate that monitoring closure effectiveness and ensuring that closure signs continue to remain readable and in place would require 20 person days over the course of the year.

Road Treatment Implemenation and Effectiveness Monitoring

Several miles of road have been proposed for decommissioning to protect public safety and to reduce concentration of surface runoff. Following treatment, we recommend monitoring the effectiveness of the treatment. We estimate that this monitoring would require five person days.

Dr. Robichaud (RMRS) proposes to monitor the effects of mulching treatments on carbon and nitrogen cycling and soil moisture retention to determine the net effects on plant recovery. The monitoring Proposal from Dr. Pete Robichaud is included as Appendix A.

Part VI – Emergency Stabilization Treatments and Source of Funds. Interim #1
To view this table as an Excel spreadsheet, right click on table → Worksheet Object →Open

			NFS Lands		
		Unit	# of		Other
Line Items	Units	Cost	Units	BAER $	$
A. Land Treatments					
Aerial Ag. Straw Mulch	acres	1150	5037	$5,792,550	$0
Aerial Wood Shred Mulch	acres	2000	560	$1,120,000	
Nox. Weeds Detect. And Treat	days	6100	6	$36,600	$0
2013 Nox. Weeds Detect. And Treat	agreement	33,000	1	$33,000	
Heritage Site Treatments	days	691	3	$2,073	
Insert new items above this line!				$0	$0
Subtotal Land Treatments				$6,984,223	$0
B. Channel Treatments					
				$0	$0
Subtotal Channel Treat.				$0	$0
C. Road and Trails					
Road Storm Proofing (outsloping, rollir	each	13764	16	$220,224	
Temp. Road Closures	each	875	3	$2,625	
Road Storm Inspection and Response	each	1800	30	$54,000	
Trail Storm Proofing	mile	2300	9	$20,700	$0
Insert new items above this line!				$0	$0
Subtotal Road & Trails				$297,549	$0
D. Protection/Safety					
S. Fork Poudre River Closure	0.5 days	96	10	$960	
Warning and Closure Signs	each	150	6	$900	$0
Closure Gate	each	2500	1	$2,500	
Closure Barrier	each	1390	1	$1,390	
Insert new items above this line!					$0
Subtotal Structures				$5,750	$0
E. BAER Evaluation					
Assesment Team Costs					$86,590
Insert new items above this line!					
Subtotal Evaluation				---	$86,590
F. Monitoring					
Mulch Effectiveness	days	350	10	$3,500	$0
Road Treatment Effectiveness	days	350	5	$1,750	
Closure Effectiveness	days	250	20	$5,000	
2013 Level 3 Monitoring: Robichaud				$29,876	
Insert new items above this line!				$0	$0
Subtotal Monitoring				$40,126	$0
G. Totals				$7,327,648	$86,590
Previously approved				$7,264,772	
Total for this request				**$62,876**	

PART VII - APPROVALS

1. /s/Ron J. Archuleta (for) May 29, 2013
Forest Supervisor (signature) Date

2. /s/
Regional Forester (signature) Date

Appendix A: Monitoring Proposal from Dr. Pete Robichaud, RMRS

Monitoring Soil Nutrients and Vegetation Response to Mulch Treatments Following the High Park Fire, CO

Introduction Mulch treatments are increasingly being used in post-fire rehabilitation efforts to prevent excessive erosion and weed establishment post-fire. Mulch effectiveness at preventing erosion is the focus of ongoing research, yet mulching effects on vegetative post-fire recovery are poorly understood. Four years after the 2005 School Fire in Washington, we observed changes in vegetation composition, carbon:nitrogen (C:N) in soils, and nitrate uptake by vegetation (unpublished data) with different mulch treatments (wood straw, wheat straw, hydromulch, grass seeding, control). This has raised some concern that mulch applications might influence plant recovery by affecting soil N availability. Mulch provides an abundance of C to feed microbial decomposition but comparatively little N, which can increase demand for N by soil microbes. This can lead to immobilization of soil N, therefore making soil N unavailable for plant uptake. Experimental studies have demonstrated that mulch application decreases plant-available N and N turnover rates and these effects change rapidly over the first several years following application. In contrast to the detrimental effects on N availability, mulch applications increase retention of soil moisture, which might aid plant growth in water-stressed environments. The net effect of mulch on plant recovery due to both increasing moisture and restricting N availability is currently unknown. There is a need to understand how mulch applications alter soil nitrogen availability that is otherwise enhanced following wildfire and critical for post-fire plant re-establishment. By coordinating with Burned Area Emergency Response (BAER) efforts on the High Park, we have the opportunity to establish plots for monitoring the effects of mulch treatments on soil N availability and plant re-establishment. Our project aims to establish connections among mulch application rates, soil N availability, and post-fire plant recovery to aid managers in post-fire rehabilitation decision-making.

Objectives We will apply mulch treatments in replicated, controlled plots on the 2012 High Park Fire severely burned areas where post-fire mulch treatments are being applied. Our objectives are to:

1. Monitor the effects of different levels of mulch application on vegetation response, and plant and soil C and N processes. The goal is to answer the following questions:
   Are post-fire plant community compositions and cover affected by the presence, amount, and/or type of mulch applied? Does mulch reduce plant available N in soils, limiting the ability of plants to take up N? Are any effects on N uptake and availability related to microbial decomposition of mulch, or rather the increase in soil moisture that the mulch cover provides? Can we relate mulch effects on plant recovery to mulch type and amount, informing managers about ideal levels of mulch for specific plant restoration goals?

2. Report our findings to managers and BAER specialists in annual reports, publications, and presentations at regional and national meetings.

Methods Monitoring plots will be established on a high soil burn severity area (i.e. with more than 70% overstory tree mortality, >90% of the area in charred, bare mineral soil as a result of consumption of organic material, including litter and duff). To allow enough replication to determine statistical differences, six 31 m by 9 m (about 102 ft by 30 ft) blocks will be established within a larger area having similar aspect, slope (10-30% slope), soil type, pre-fire tree basal area and understory plant species composition, as best as can be judged at the time of treatment application. Two levels of each of three BAER mulches will be applied within each block, including one area for application of synthetic mulch and one area reserved as a control (Figure 1 and Table 2). The synthetic mulch will serve as a "null" treatment and allow us to determine whether BAER mulch effects are due to additions of C or simply increasing soil moisture. Pre-treatment soil C and N levels will be measured to serve as a baseline against which future changes will be compared. Soil temperature (iButtons, Maxim Corp.) and moisture sensors (ECH2O, Decagon Devices) will be installed in each subplot to monitor mulch effects on the soil environment. Additionally, wood stakes will be used as an index of organic matter decomposition and soil biological activity. Mesh bags containing mulch will be installed at each plot to monitor the annual change in C and N content of mulch as it decomposes. Resin bags (UniBest Corp.) will

be placed in each subplot and harvested once in the fall to monitor how the mulch treatments are affecting soil available N. In addition, soil samples will be collected annually and tested for gross N immobilization and mineralization to understand how the mulch treatments are affecting microbial N cycling, which controls plant access to soil N. Once a year, plant species cover will be measured in each plot and plant and root samples will be collected to monitor changes in plant C and N uptake.

Statistical Analyses Analyses of covariance will be used to determine differences in plant cover, biomass C:N, soil C:N, mulch C:N, plant-available N, gross N mineralization and immobilization, mulch mass loss, and wood stake strength loss among the different mulch types compared to the control, accounting for variance among the three different levels of mulch applied. Regression will be used to determine whether relationships exist between metrices above and soil moisture, original mulch C:N, or amount of C applied as mulch.

Deliverables Results will be incorporated into annual progress reports to be completed by April of each year and disseminated in at least one local or regional meeting and/or national meeting with BAER specialists. In addition, two technical documents, one on plant recovery and one on soil C and N cycling, will be written.

Table 1. Budget

Year 1 (July 2012 through September 2013)

Item	Description	Amount
Labor	Labor by Project Manager and Technician for project coordination and plot establishment activities	$15,548
Analytical fees	Pre-treatment soil analysis, resin and mulch CN	$3,905
Equipment	Sensors and materials for decomposition bags, synthetic mulch, and general field and lab supplies	$3,128
Travel	Vehicle for plot establishment. Travel for site identification and stake installation.	$4,950
TOTAL	**Year 1**	**$27,531**

Year 2 (Oct 2013 through Sept 2014) and Year 3 (Oct 2014 through Sept 2015)

Item	Description	Amount
Labor	Labor by Project Manager for project coordination and annual monitoring activities	$21,280
Analytical fees	CN analysis of soil, mulch, plants, and roots; N analysis of resin bags; soil N immobilization and mineralization tests; wood stake analysis	$4,896
Equipment	general field and lab supplies	$700
Travel	vehicle for 20 days of field sampling; travel to local and national meetings	$3,000
TOTAL	**Year 2**	**$29,876**
TOTAL	**Year 3**	**$29,876**

We request monitoring funds to assist with plot establishment, field measurements, lab analysis, drafting reports and technical documents. Two field technicians will be needed to assist with plot establishment. Vehicle expenses are required to travel to the field site for plot establishment and sample collection. Some additional travel funds for non-local personnel are included. When possible, preparation of samples for analysis will be done locally and samples will be analyzed using instrumentation at collaborating institutions (CSU).

Project Contacts:

Pete Robichaud (208 301 0158 cell) and Debbie Page-Dumroese, Rocky Mountain Research Station, 1221 S. Main, Moscow, ID 83843 probichaud@fs.fed.us, ddumroese@fs.fed.us,
Erin Berryman (970 491 7091 cell), Department of Forest and Rangeland Stewardship, Colorado State University, Fort Collins, CO 80523-1472;
Penny Morgan (208 301 1852 cell), Department of Forest, Rangeland, and Fire Sciences, University of Idaho, Moscow, ID 83844-1133; pmorgan@uidaho.edu
Eric Schroder (303 541 2538), Soil Scientist, Arapaho and Roosevelt NF, Boulder, CO; eschroder@fs.fed.us

Table 2. Mulch application rates

Mulch type	BAER Target	% cover target	Amount per 28 m² subplot (lbs)		No. of subplots	Total mulch (lb)
			Target	High		
Wood shreds	13 Mg/ha (1.3 kg/m^2)	68	36.4 kg (80 lb)	54.6 kg (120 lb)	6	**546 kg (1204 lb)**
Wood straw	13 Mg/ha (1.3 kg/m^2)	68	36.4 kg (80 lb)	54.6 kg (120 lb)	6	**546 kg (1204 lb)**
Ag straw	2 Mg/ha (0.2 kg/m^2)	70 to 80	5.6 kg (12.3 lb)	8.4 kg (18.5 lb)	6	**84 kg (185 lb)**
Synthetic (recycled rubber)		70%	210 ft^2 at 1" thick = 17.5 ft^3		6	**105 ft^3**

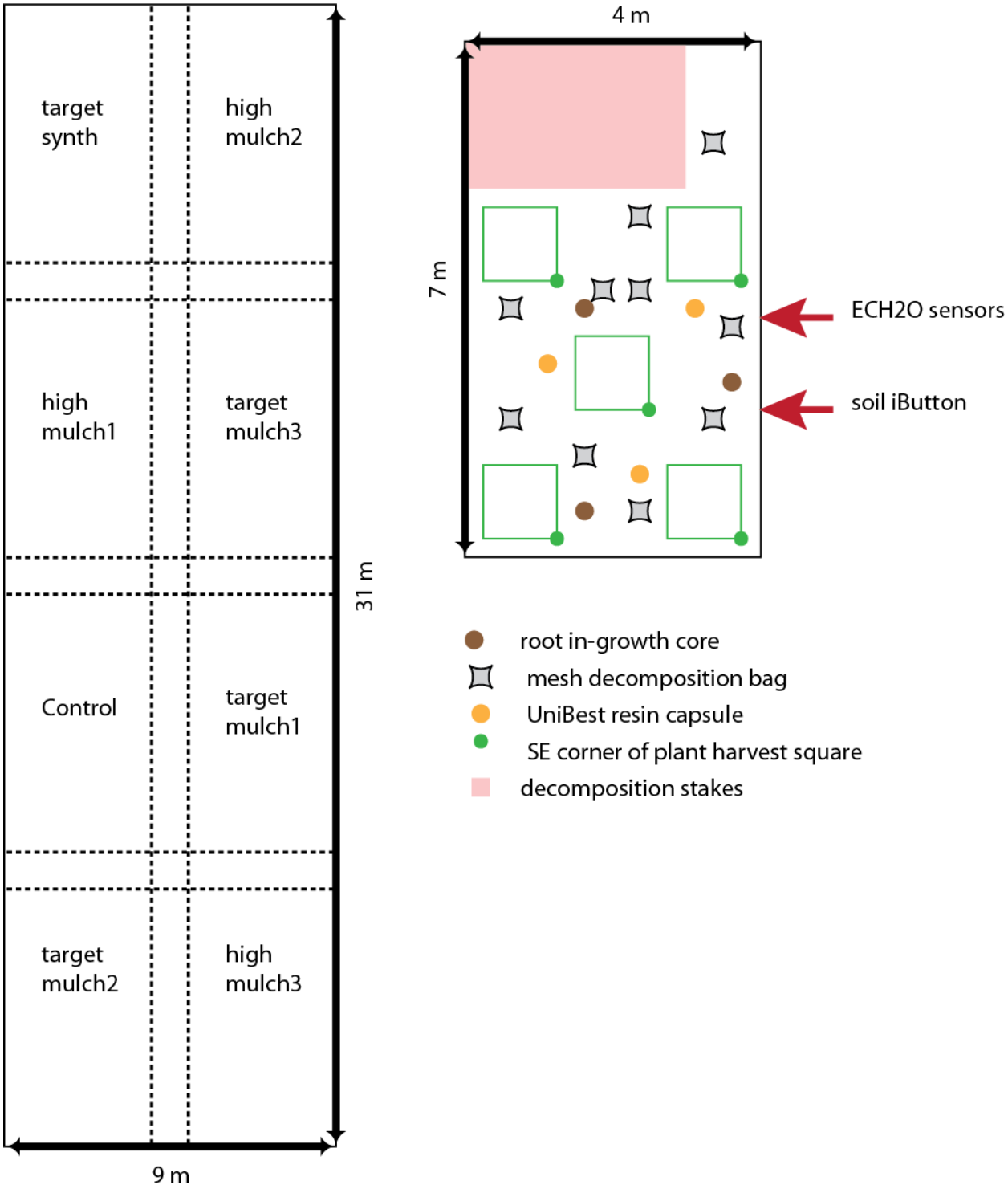


Figure 1. Block (left) and subplot (right) layout. Six blocks will be placed at the site in areas with consistent slope, aspect, pre-fire vegetative cover, and soil type. One-meter-wide buffer strips separate the subplots from each other, and all subplot sampling will occur at least 0.5 meter from the subplot edge. ECH2O and iButton sensors will be inserted into the plot area via a soil pit dug at the east edge of the subplot.

Schedule of Work

2011-2012 Plot Establishment (soon after fire)

Lab: Mesh decompositions bag construction (n=360)
Root in-growth core construction (n=480)

Field: Plot establishment within burned area
Apply mulch treatments to plots; Installation of instruments (Figure 1)
Collection of soil for pre-treatment observations of total C and N (n=144)

September/October 2012 (before first freeze)

Field: Resin bag extraction (n=144)
Installation of root in-growth cores (n=144)

2012-2013 Fall/Winter

Office: Data entry, planning, drafting reports

May (or ASAP after snowmelt)

Field: Resin bag installation (n=144)
Wood stake installation (n=1200)

June (1 year following plot establishment)

Field: Mulch decomposition bag collection (n=72)

August/September (peak of plant growth – before first frost)

Field: Species cover assessment; Soil sampling (n=48); Aboveground plant harvest; Foliage collection for nitrate reductase assay; Stake extraction (n=240); Resin bag extraction (n=144); Root core extraction, replacement (n=144)

2013-2014 and 2014-2015 Fall/Winter

Lab: Root core sorting; Soil, mulch and plant sample drying and preparation for CN analysis
Soil incubation and extraction for N mineralization/immobilization assays

Office: Data entry, planning, drafting reports

May (or ASAP after snowmelt)

Field: Resin bag installation (n=144); Wood stake extraction (n=240)
Mulch decomposition bag collection (n=72)

August/September (peak of plant growth – before first frost)

Field: Species cover assessment; Soil sampling (n=48); Aboveground plant harvest
Foliage collection for nitrate reductase assay; Stake extraction (n=240)
Resin bag extraction (n=144); Root core extraction, replacement (n=144)