United States Department of Agriculture | Forest Service | Gallatin NF | PO 130 Bozeman, MT 59771

File Code: **2520 BAER** **Date: 10/26/2007**

Subject: Derby Fire BAER– Implementation Monitoring Review

To: Big Timber District Ranger

On October 10 and 11th, 2007 an Implementation Monitoring Review was held for the Derby Fire BAER treatment on the Big Timber Ranger District of the Gallatin NF. In attendance were Bill Avey, Ron Archuleta, Lisa Stoeffler, Scot Shuler, Sally Orr, Frank Cifala, Pete Becken, Mark Story, Henry Shovic, Jonathan Kempff, Bruce Sims (RO), and Jim Wickel (RO). The review focused on roads, trails, weeds, fences, and fisheries (helimulching) treatments which were completed from October 2006 to October 2007. The Derby fire was a massive 207,115 acre lighting ignition wildfire during August and September 2006 with considerable jurisdictional complexity (Gallatin and Custer NF's) as well as State of Montana, BLM, and private lands. About 57% of the Derby Fire burned acreage is in private ownership.

The primary values at risk on National Forest lands were judged to were transportation routes (roads and trails), rangeland forage, and sensitive fish populations. The primary concerns include post-fire flood flows, erosion and sedimentation, lack of livestock control for rangeland recovery, and extensive weed spread potential from existing weed infestations.

Implementation of Derby BAER has been difficult with substantial treatment funding complexity requiring 5 interim plans, multi-funding sources and jurisdictions for several treatments, need for intensive private landowner participationation, road implementation coordination with ERFO funds, several rain events with accelerated erosion and debris flows, difficulty in completing agreements for weed and range work, and a large workload in getting all of the allocated funding under contracts.

The Derby BAER implementation review was intended to evaluate (at a point in time of 10/2007) the implementation and effectiveness of the BAER treatments, to document findings and recommendations for consideration in future Gallatin NF BAER efforts, and augment monitoring documentation support for interim requests for FY 2008.

Derby BAER review team evaluating Derby Gulch road # 6674 treatments on 10/10/2007.

The process for the Derby BAER review consisted of:

1. Identification and listing of BAER rating items from the approved BAER plan.

2. Field review of representative roads and a trail in Derby Gulch and West Bridger Creek, weed treatments in Cherry Creek, fence construction in WF Upper Deer Creek , and a fisheries treatment area in Placer Gulch.

3. Team ratings (consensus) for application and effectiveness of BMP's of treated areas observed using the Montana Forestry BMP audit format.

4. Team recommendations for maintenance or addition Derby BAER treatments and future GNF BAER projects.

Objectives and mitigtion measure and effectiveness definitions included:

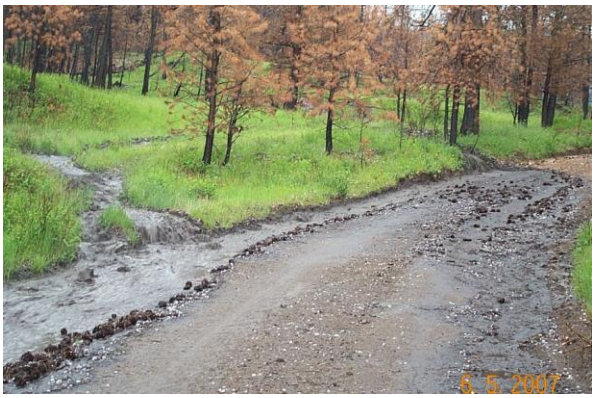
Application
5- operation exceeds requirements of objective or measure
4- operation meets requirements of objective or measure
3- minor departure from measure, objective marginally met
2- major departure from measure, objective sporadically met
1- gross neglect of measure, objective not met

Effectiveness
5- improved conditions over pre-project condition
4- adequate protection of resources, effective
3- minor and temporary impacts on resources, moderately effective
2- major and temporary or minor and prolonged impacts on resources or only slightly effective
1- major and prolonged impacts on resources or not effective

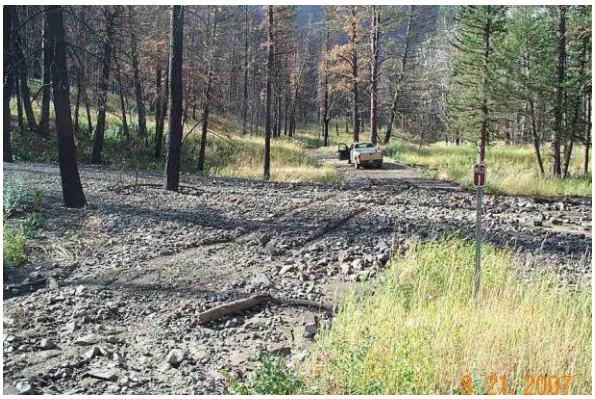
Evaluation Items - BMP's	source	Applic	Effect	Comments
Roads - Protect travel routes and downstream aquatic systems during first 2 years				
1. Install 124 drain dips	Derby BAER plan pg. 7	4	3	Could have used twice as many drain dips
2. Remove 9 culverts and upsize 30 culverts to handle projected 5 year stormflow runoff events.	Derby BAER plan pg. 7	4	4	In future GNF BAER plans upgrade to 10 year stormflow runoff events and size only to top of culvert not to road deck
3. Reinforce the culverts's ability to handle peak flows by augmenting the inlet and outlets additional rock and clearing slash out of the channels	Derby BAER plan pg. 5	4	4	Consider arranging inlet rock to form a "funnel" effect for more efficient debris passage
4. Clean and rock armor ditch relief culverts	Derby BAER plan pg. 5 & 7	4	4	Cleaned spring of 2007 then in 8/07 and 9/07 after rain events

Trails - Protect travel routes and downstream aquatic systems during first 2 years				
1. Install 644 waterbars	Derby BAER plan pg. 7	4	3	Generally sufficient waterbars installed but plugged after rain events. Maintenance will needed next 2 years. Minimum 7"-8" size logs, grade of waterbars >2% more than trail grade. Install waterbars in mid erosion slope locations not at bottom of erosion slope.
2. Remove 700 hazard trees that threaten BAER crews	Derby BAER plan pg. 7	4	4	Actual removal less than planned
3. Installation of 12 trail hazard warning signs	Derby BAER plan pg. 7	3	3	Should have put signs in more strategic locations with a more localized message and larger font
Invasive Species – Reduce the expansion of noxious weeds on Federal Lands				
1. Agressively treat 470 acres the first year.	Derby BAER plan pg. 6	4	4	Used Tordon and Overdrive herbicides. some areas treated 2X
2. Competitive native grass aerial seeding the first year	Derby BAER plan pg. 6	4	4	Seeded by hand in early spring
3. Wyden ammendment boundary weed treatments (aerial herbicide, ground) to reduce weed expansion to NF, 620 acres	Derby BAER interim #3 pg. 3-4, 6	4	4	Treated entire 17 mile corridor (about 300' of private land adjuacent to NF) 2X
4. Wyden ammendment boundary weed treatment - aerial seeding to reduce weed expansion to NF, 620 acres	Derby BAER interim #3 pg. 3-4, 6	na	na	Not completed since agreement with Sweetgrass County not done in time to for seeding window
Rangelands – Exclude grazing disturbance during the recovery period				
1. Construct temporary fence to exclude cattle from burned National Forest Lands	Derby BAER plan pg. 5	4	4	Limited trespass since most of the adjacent private lands were being rested via NRCS EQUIP program. 6.5 miles of boundary fence done primarily by landowners with FS provided supplies (CWK2 and NFN3). 3 miles of internal fence contracted. ~~non-BAcon~~
Fisheries/Aquatics – Reduce surface erosion and sediment delivery to critical habitat for YCT				
1. Apply heli-mulch to 40 acres of high burn intensity area on Placer Gulch.	Derby BAER plan pg. 7 Fisheries Resource Report pg. 13	4	4	Adequate dispersion of straw from helicopter. No erosion or stream scour in treated areas

Derby BAER review findings will be illustrated in photos:

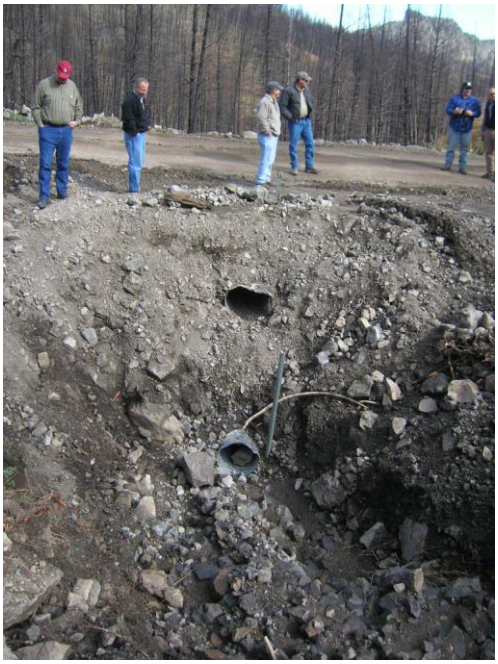


Snowmelt runoff and May/June 07 spring frontal storms resulted in greatly increased overland flow and some erosion in road ditches and fills. However spring rainfall intensity was moderate and did not result in debris flows and only a few clogged culverts in Derby Gulch.

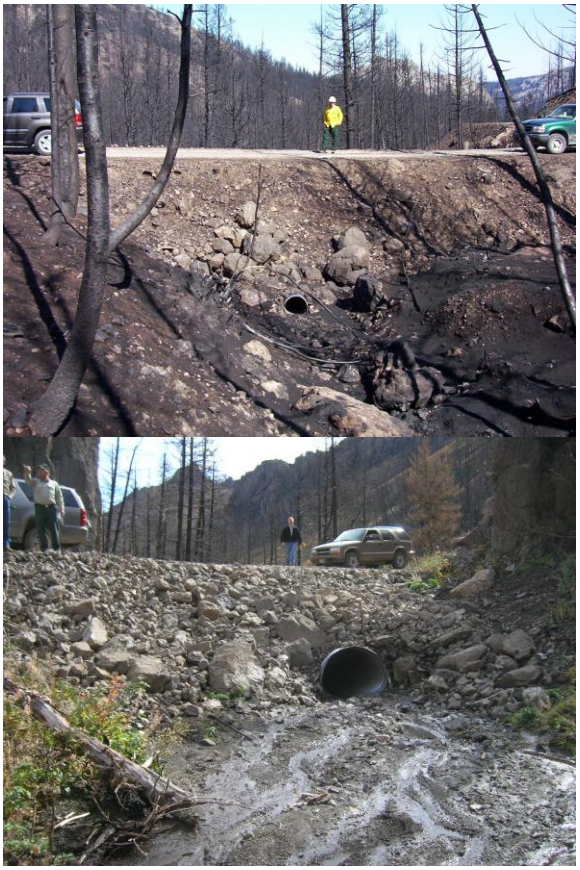


Two localized summer convection storm events (August 18 and September 20) triggered a number of small debris flows in Derby Gulch which resulted in some areas of debris over the road surface and several clogged culverts.

Derby Gulch culvert near the confluence with West Bridger Creek which was upgraded from 2 @ 3' culverts which plugged during the 5/05 frontal storm event estimated at 193 cfs. This culvert was replaced with ERFO funding but the design was upgraded with BAER funds to a single 6' culvert with an estimated capacity of 325 cfs to provide sufficient capacity to handle the estimated Q5 burned event of 322 cfs. Derby Gulch stormflows in 2007 were not sufficient to challenge the culvert capacity.

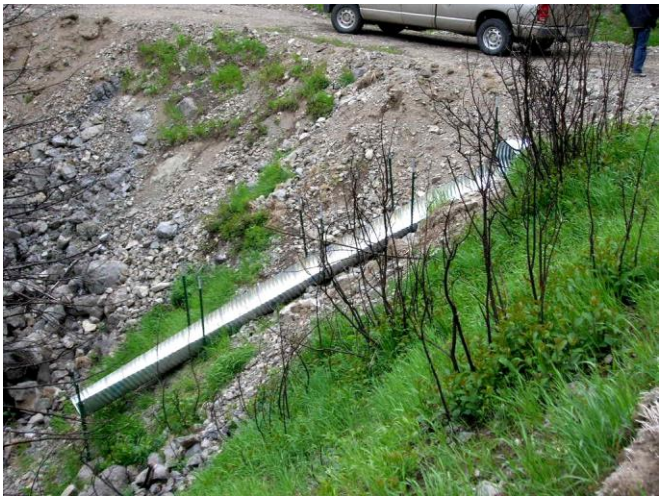


Six Derby Gulch culverts were judged to be too small to handle the 5 year burned event so were augmented with an additional culvert higher in the road fill. Most of these original culverts were plugged in the 8/18 event but the additional culverts provided sufficient capacity to avoid road fill erosion. The review team concensus was that this double culvert design is inferior to replacing the undersized culvert with a single larger culvert since considerable maintenance work is required to clean out the lower plugged culverts and the 2nd culvert is still vulnerable to plugging. Where possible, all drainage culverts were agumented with armored dips to "vent" the culverts in case of overtopping.



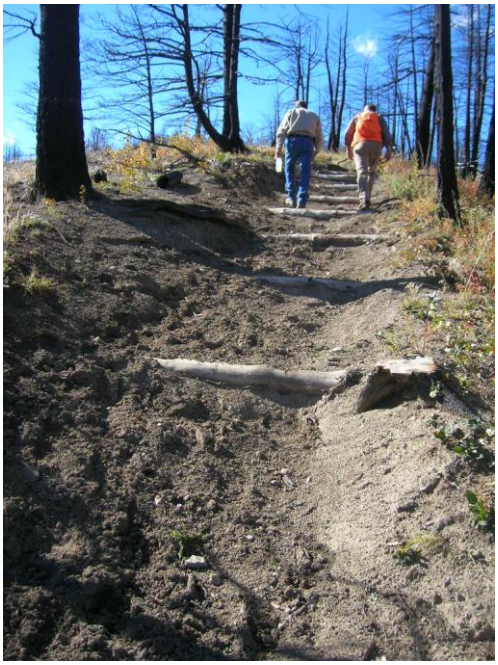
Derby Gulch culvert replacement. The upper photo (9/06) is of a 30" culvert which was too small to handle a 5 year burned discharge event. The lower photo (11/07) is of the 5' replacement culvert. The replacement design included allowing water to pool to the top of the road deck for additional capacity. The review team concluded that the 5 year recurrence interval burned criteria was too conservative and doesn't provide sufficient capacity, particularly considering the considerable potential debris which "bulks" the effective discharge to as much as 2X and can plug the culvert inlet. The review team recommended that future GNF BAER design criteria use a 10 year burned recurrence interval and constrain design stage to the top of the culvert. This revised design criteria would have resulted in a 6' culvert, which is more expensive, but has more hydraulic capacity Derby with less plugging potential.

West Bridger Creek replacement culvert. All of the new culverts had considerable rock placement at the inlets and outlets. Note the overflow drain dip on the left side of the photo. The combination of rock and drain dips greatly reduces potential road failure if the culvert overtops or plugs.

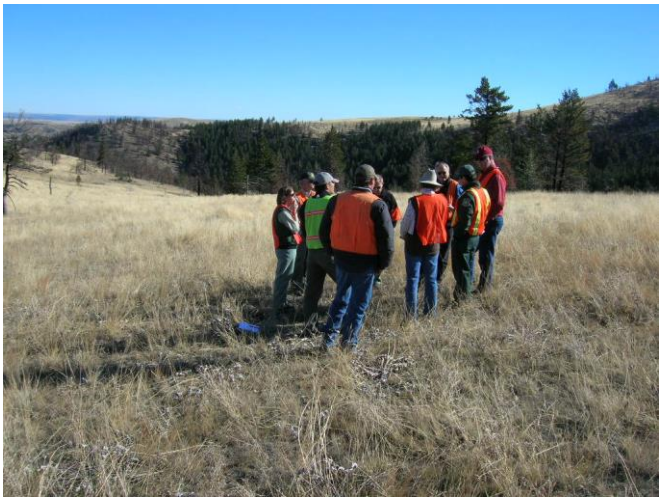


In upper Derby Gulch, 4 downspouts were constructed in areas where small side drainages and ditch relief culverts posed potential for fill slope erosion. Each of the downspouts carried the 2007 stormflows with no road surface or fill slope erosion.

124 relief dips were installed to reduce road erosion potential in Derby BAER. The photo at left was taken in October 2006 on Packsaddle Butte Road #6675 which was quite effective. Many of the dips were converted to rolling dips (for roadside salvage log trucks) during May of 2007 with 1' elevation between the dip trough and crest. The rolling dip conversion compromized the dip capacity but only 1 dip was observed to be "undersized". The review team felt the relief dips were a very effective treatment and in fact recommended doubling the density in future GNF BAER projects.



Constructed waterbars and check dams in Jim's Gulch Trail #129 (West Bridger). This section of trail was gullied pre-fire by insufficient drainage compounded by motorcycle and ATV use. Some of the review team members suggested that several of the check dams could have been installed as longer waterbars with better direction of stormflow runoff from the trail. In the Derby BAER implementation approximately 644 waterbars were installed. Many of these waterbars, however, filled with overland flow sediment after each substantial rain event and will require maintenance cleaning 2-3 times per year from the next 2 years. The team noted that waterbars should generally be constructed at mid-slope, at least 2% steeper than the trail grade, and at least 7-8" in diameter. Hazard trees were removed for the protection of BAER team workers but not as many hazard trees needed to be removed as authorized in the Derby BAER plan. Lodgepole pine and spruce are especially likely to become hazard trees.



Weed treatment area on a bench above Cherry Ck. This area was treated twice in private land – Wyden ammendment treatments. Derby BAER treated about 350 acres on NF land and 620 acres on private land (Wyden). The main noxious weed of concern is leafy spurge. Treatments were judged to be effective in reducing spurge establishment on the burned grassland although yearly maintenance treatment will be needed. Annual weeds invasion has been occuring in the area burned in the west part of the Derby fire, including areas from the 1994 Black Butte fire for at least the last 2 decades. Drought has reduced the vigor of native grass/forbs to compete with the annual weeds.

Fence and fence ROW off the Iron Mountain Road #482 in Lower Deer Creek near the Tomato Canyon trailhead. About 34 miles of boundary fence and 12 miles of GNF interior fence were damaged or destroyed in the Derby Fire. NFN3 and CWK2 funds were used to purchase fence material for permitees. About 6.5 miles of boundary fence and 1 mile of interior fence were constructed in 2007 with an additional 3 miles of interior fence under contract. Most of the permitees were participating in the NRCS EQIP deferrment program in 2007 so trespass onto GNF was minimal in 2007. Several barriers were burned, however, so resumption of adjacent land grazing will make it very difficult to constrain adjacent private land grazing in 2008 and beyond. Approximately 36 miles (24 additional) of interior fence are estimated to be needed to control livestock. Construction of the remaining boundary fence will be important to adjacent private landowners with the work (clearing, rolling up old fence, installing new fence) estimated to cost $10,000 to $12,000 per mile.

High burn intensity hillside above Placer Gulch on 10/13/2005. Placer Gulch has a population of Yellowstone Cutthroat trout and was selected a a “refugia” reach if Lower Deer Creek, which was highly burned, is heavily impacted by stormflow/sediment events. About 40 acres of Placer Gulch were treated with helimulch in an attempt to reduce potential sediment impacts. Based on WEPP soil erosion modeling, the 40 acre Placer Gulch treatment could reduce soil loss from approximately 39.1 tons/acre to 10.8 tons/acre which poses a substantial risk reduction for YCT habitat.

Scot Shuler and Bruce Sims examined the Placer Gulch hillside for helimulch treatment effectiveness on 10/11/07. Good distribution of the helicopter applied mulch was observed with some mulch clumps. The upper photo includes a mulched area in the foreground and un-mulched in the background. The Placer Gulch area was not impacted by a localized heavy rain event in 2007 but some erosion deposition was observed below logs in adjacent un-mulched areas. More vegetation was also observed in mulched areas which consisted of wheat and rye grass in the straw mulch and native vegetation. The increased vegetative cover in the mulched area is likely due to reduced soil temperature and increased moisture retention below the mulch. The lower photo is in an ephemeral draw which runs through the center of the treated area. No overland flow in 2007 was evident. The application rate was judged to be adequate although helicopter treatment altitude increase of about 100' could avoid some of the observed mulch clumping. Overall the Placer Gulch helimulch treatment was judged to be effective in preventing erosion and subsequent sedimentation but may be more rigorously "tested" if more robust rain events impact the treatment area in 2008.

Conclusions

1. In general the first year of Derby BAER implementation of treatments have been completed as specified in the 2500-8 and 5 interim plans, and have been effective. A wildfire the size and compexity of the Derby Fire is a huge and long term impact on the Big Timber District. Derby BAER implementation has been very complex with substantial treatment funding issues, multi-funding sources and jurisdictions for several treatments, need for intensive private landowner participation, road implementation coordination with ERFO, CMRD, KV2 and other funds, several rain events with accelerated erosion and debris flows, difficulty in completing agreements for weed and range work, and a large workload in getting all of the allocated funding into contracts.

2. The Derby BAER funding, like many other BAER projects, has been essential in providing timely funds to deal with several facility and ecological concerns such as maintaining road ditch capacity, upgrading culvert size to reduce the potential for roads being washed out, routing water off of system trails, hazard tree safety protection for BAER workers, essential safety signs, herbicide and seeding treatments for weed infestation expansions, protection of burned rangelands from livestock use before sufficient recovery, and localized protection of key Yellowstone trout spawing and rearing areas. Without the availability of BAER funds many of these wildfire related problems could not be be mitigated in a timely manner.

4. The Derby fire has greatly increased the potential for expansion of existing weed infestations form both GNF lands and adjacent private lands. The weed issue expansion is also compounded by the 1994 Black Butte wildfire and persistent drought in the Derby Fire area.

5. The Derby fire has substantially compounded the livestock containment difficulty in many of the Derby fire allotments. Securing funding for boundary and internal fence replacement is constrained by BAER funding guidance which only allows temporary fence replacement. Although in the case of Derby BAER, fence repair funding was augmented with NFN3 and CWK2 funds, a challenging agreements and logistical coordination workload remains which will require a few years to construct all of the needed fences for livestock control.

6. The roads and trails, and weed infestations treated with Derby BAER funds will need maintenance treatments for at least FY2008 and FY2009.

Recommendations

1. In future GNF BAER design criteria for road culvert replacement use a 10 year burned recurrence interval for culvert disign and constrain the stage of inflow to the top of the culvert and not the road deck. This will result in larger culvert sizes but will reduce the potential for culvert blocking and road fill erosion. For watersheds with a large percentage of high intensity burn the 10 year burned recurrence interval will correspond to approximately a 100 year pre-burn event.

2. Double culverts in a road fill (horizontal or vertical stacking) frequently resulted in clogged or plugged culverts for both pre-BAER and BAER treatments. In future GNF BAER treatments it is recommended to upsize culverts (to a 10 year burned RI) as a single culvert rather than add additional culverts to a fill slope. Consider adding beveled inlets to pipes to increase inlet efficiency. In locations where large amounts of organic debris are anticipated construct funnel shaped rip-rap culvert approaches to reduce the likelihood of culvert inlet clogging. Consider replacing undersized culverts with temporary fords in lieu of culverts on low use roads to reduce BAER maintenance needs. In larger streams with high potential tree debris consider using in channel trash racks to protect downstream stuctures.

3. Drain dips (for light use roads) or rolling dips (for moderate to heavy use roads) are very effective and relatively inexpensive BAER treatments. In future GNF BAER efforts the dip density in intensively burned areas should double the Derby BAER rate to about 500 – 800 feet frequency depending on road grade and adjacent burn intensity. Down spouts are very effective on reducing erosion on large fill slopes.

4. Trail waterbars are very useful to reduce trail erosion and damage from the increased overland flow from wildfires. However trail waterbars can easily clog after localized intensive

rain events and will need to be cleaned at least 2-3 times for a couple of years after a wildfire. In future GNF BAER efforts recognize the likely need for trail waterbar maintenance for at least 3 years until watershed vegetative recovery reduces the overland flow increase.

5. Wildfires in transitional areas between continuous conifers and open rangelands can have a substantial potential for stimulating expansion of noxious weed infestations. This will likely require several years of weed treatments to mitigate weed increases. Cooperation with multiple weed control local agencies is key in constraining weed expansion.

6. Encourage a change of USFS BAER policy to allow, where appropriate, construction or replacement of livestock containment fences with permanent fences either internal or on NF boundaries. The current policy of BAER temporary fence construction is not efficient for protecting burned areas from livestock grazing.

7. Hillslope treatments should only be used if there is a very direct link between the treatments and an adjacent discreet risk such as a structure or valuable resource. The analysis used to design the Placer Gulch helimulch treatments is a good example of a strategic and well documented selective use of an expensive treatment to protect a very specific value at risk – in this case a Yellowstone Cutthroat population “refugia” in a watershed with considerable high intensity burn.

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