Short-term effects of fire and postfire rehabilitation on understory vegetation (Hayman Fire, Colorado)

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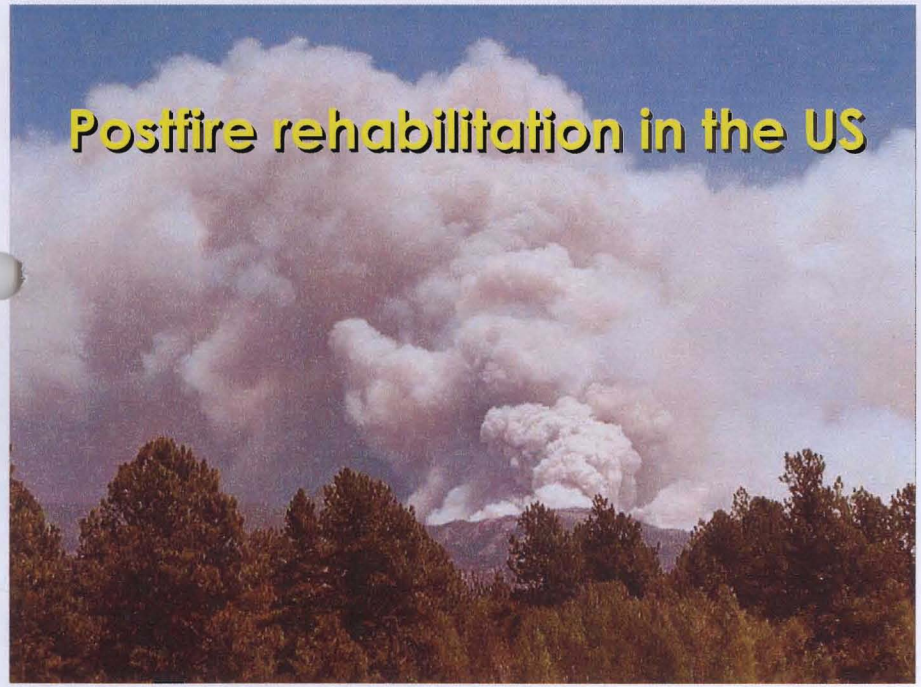
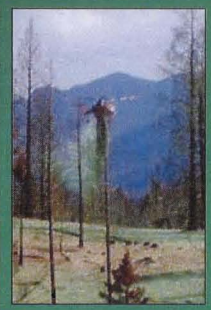
Overview of today's talk

- Postfire rehabilitation in the US
- Our findings: Effects of rehab on forest understory
- The bigger picture
- Conclusions and recommendations

Postfire rehabilitation in the US



Land managers often rehabilitate portions of recently burned areas

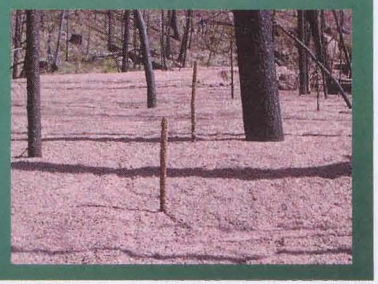
Common treatments:

- Seeding
- Mulching
- Erosion barriers
- Soil scarification

Postfire rehabilitation on USFS land: BAER (Burned Area Emergency Rehabilitation)

4 main objectives:

1. Minimize threat to life and property
2. Stabilize soil
3. Control water, sediment, debris movement
4. Prevent permanent impairment of ecosystem structure and function



Beyers 2004

Brief history of BAER in the US

- 1920's: Postfire seeding with native shrubs in CA chaparral
- 1974: formal USFS BAER program developed; annual budget for USFS BAER treatments set at $2 million
- 1987: large fires in CA, OR caused expenditures to exceed authorized amount; cap removed
- 1990's: BAER policies integrated across different Federal agencies; importance of training, monitoring, using native species realized

Robichaud et al. 2000, Beyers 2004

BAER: 10 costliest fires for BAER treatment (as of 1998)

Table 9—The 10 costliest fires for BAER treatment spending. All amounts are in 1999 dollars.

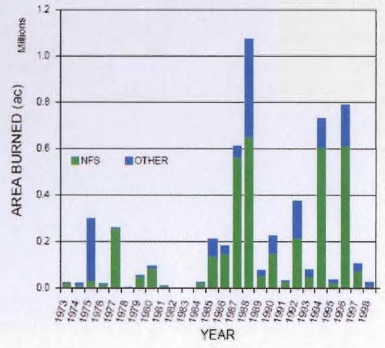
Fire Name	National Forest	Year	NFS (ac)	NFS (ha)	Total (ac)	Total (ha)	NFS ($)	Total ($)
Rabbit Creek	Boise	1994	94880	38425	94880	38425	8,420,000	8,420,000
Foothills	Boise	1993	139955	56680	257600	104330	8,251,500	8,346,000
Tyee Creek Complex	Wenatchee	1994	105600	42770	140195	56780	6,156,100	8,978,000
Lowman Complex	Boise	1989	95000	38475	95000	38475	3,215,500	3,215,500
Stanislaus Complex	Stanislaus	1987	117980	47780	139980	56690	2,109,450	2,609,450
Fork	Mendocino	1997	61930	25080	82993	33610	1,839,100	1,888,000
Buffalo Creek	Pike-San Isabel	1998	11320	4585	11900	4820	1,800,200	2,146,400
Clover Mist	Shoshone	1988	194000	78570	387000	156735	1,393,500	1,393,500
Eighth Street	Boise	1997	3160	1280	15193	66155	1,207,000	8,562,400
Clarks Incident	Plumas	1988	30000	12,150	40000	16,200	1,024,000	1,289,000

Fire	Year	NFS ac burned	Total ac burned	NFS BAER spending
Hayman, CO	2002	122,060	137,760	$24,787,270
Rodeo-Chediski, AZ	2002	177,439	462,614	$10,379,312
Biscuit, OR & CA	2002	489,145	497,898	$9,400,000

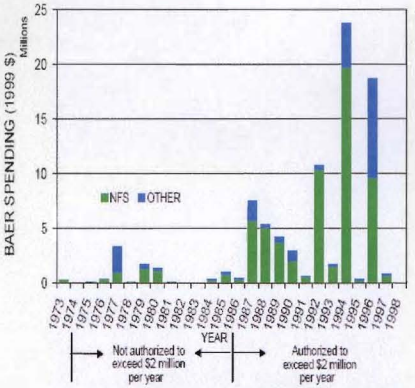
Robichaud et al. 2000

BAER

Area burned 1973-1998

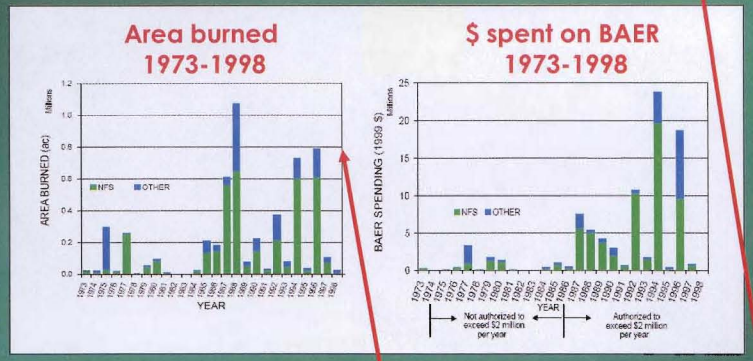


$ spent on BAER 1973-1998



Robichaud et al. 2000

BAER



Fire	Year	NFS ac burned	Total ac burned	NFS BAER spending
Hayman, CO	2002	122,040	137,760	$24,787,000
Rodeo-Chediski, AZ	2002	377,439	462,614	$3,399,312
Biscuit, OR & CA	2002	489,145	497,898	$9,400,000

800,000 ac

$45 million!

BAER

In the past 30+ years:

- Millions of acres have burned on USFS lands
- Millions of burned acres have received BAER treatments, costing millions and millions of dollars

IN SPITE OF ALL THIS, VERY LITTLE EFFORT HAS BEEN PUT INTO MONITORING-

- The effectiveness of these BAER treatments
- The effects of BAER treatments on understory recovery

BAER

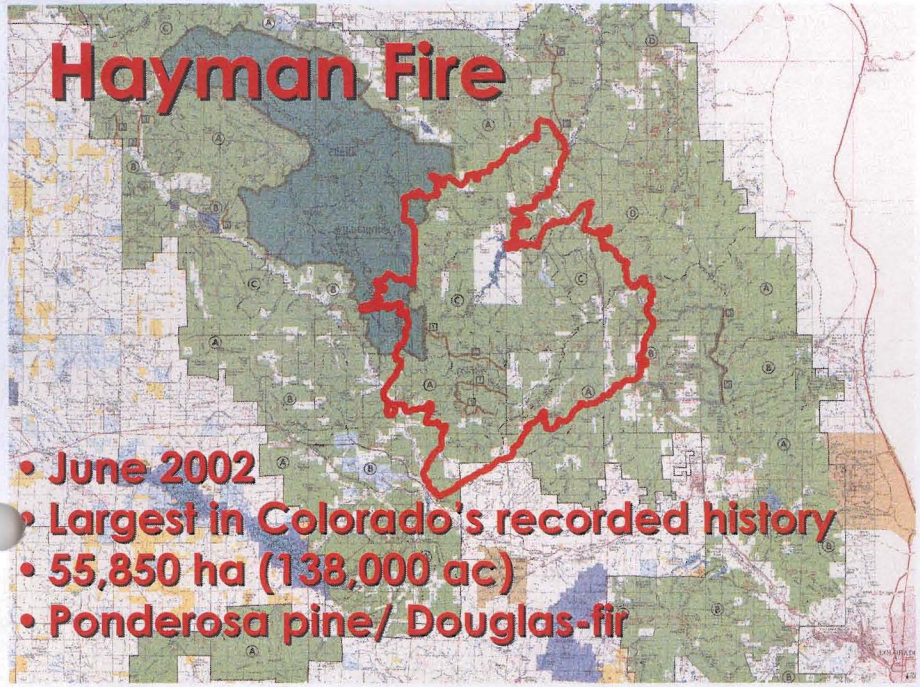
Example: the 2002 Hayman Fire

- 45% of burned USFS acres treated
- BAER rehab $25 million
- Monitoring- $39,000

Our Research Question:

What are the effects of wildfire and postfire rehabilitation on native and non-native plant species?

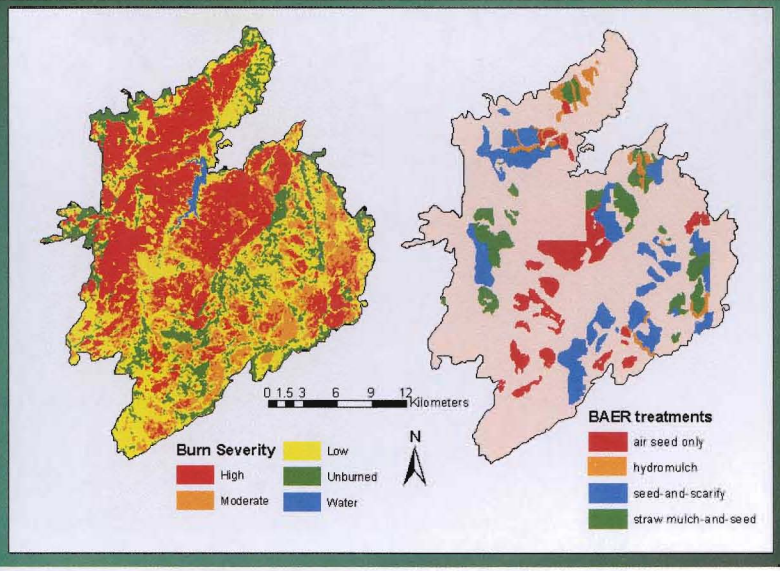
- **Total richness, cover**
- **Most common individual species**



Hayman Fire

- Several factors make this area extremely susceptible to postfire erosion:
  - Forest condition is overly dense and capable of supporting high-severity wildfire
  - Very erosive soils- some of the most erosive in the country
  - Steep terrain
  - Precipitation comes largely in intense summer storms

Hayman Fire



Seed-and-scarify treatment

Purpose: reduce erosion by providing ground cover and increase infiltration by scarifying

- Used on nearly half of the federally treated land in Hayman(13,000 of 31,600 ac)
- Completed in 2002
- Scarification done by ATVs and by hand; Seed applied by hand
- Seed treatment: certified weed-free mixture of 70% barley, 30% triticale (wheat/rye hybrid)

Robichaud et al. 2003

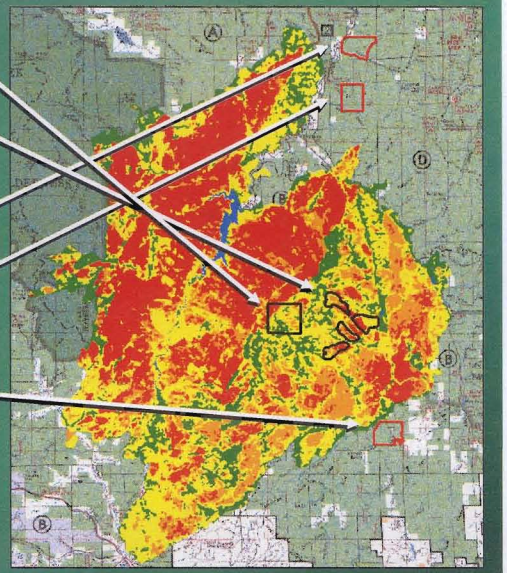
Methods: Study Areas

Burn-only: Turkey Creek

Burn+rehab: Sheep Nose

Reference (unburned):
- -Sugar Creek
- -Hatch Gulch
- -Manchester Cr.

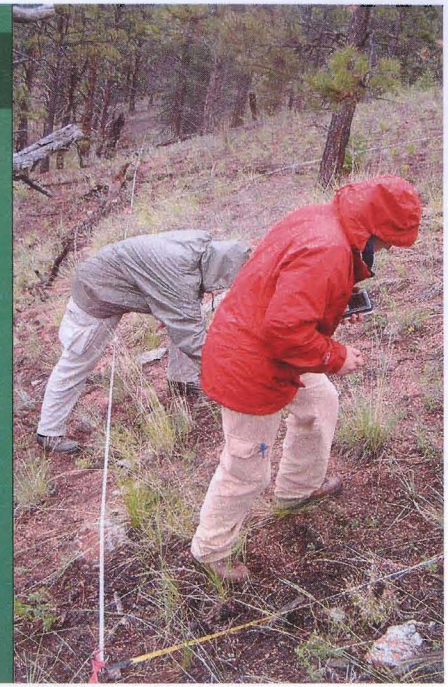
Data collected in 2004
(2 years postfire)



Methods

For all study areas:
- 15 plots per study area
- Plots stratified by topographic position

For all plots: Mod-Whit layout
- Plot size: 20 x 50m (1000 m^2)
- 1 m^2, 10 m^2, and 100 m^2 subplots nested within it
- Complete understory inventory in each subplot
- Cover estimates by species in 1 m^2 subplots



Methods: total species richness, cover

- Species richness per plot (natives, non-natives)
- Percent cover per plot (natives, non-natives)

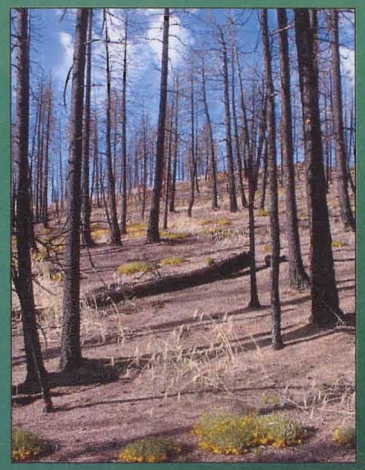
Methods: individual species analysis

Used individual plant frequency and cover data to classify each common understory plant

1. Tolerant: the species was unaffected by the fire +/- the postfire rehabilitation treatment
2. Stimulated: the species was positively affected
3. Sensitive: the species was negatively affected

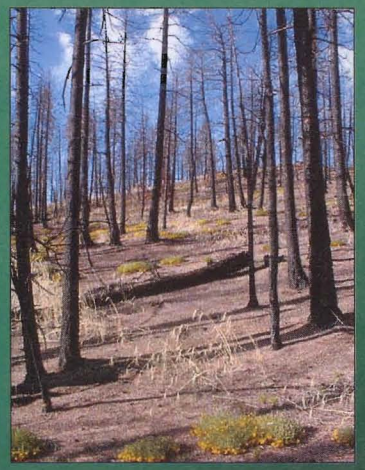
Bottom line: post-fire rehabilitation treatment

- Seeded grass species were not found in any of the reference plots
- Seeded grasses were present in the burn+rehab plots and in the burn-only plots
- Of the two seeded species used, only triticale established in our plots



Bottom line: post-fire rehabilitation treatment

- Triticale frequency and cover were marginally higher in burn+rehab plots than in burn-only plots
- However, it established poorly in both cases
  - Frequency: <10% of the subplots (1 m^2 each)
  - Cover: <1%

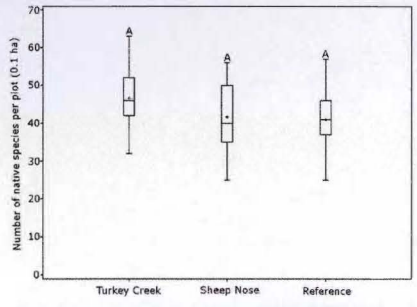


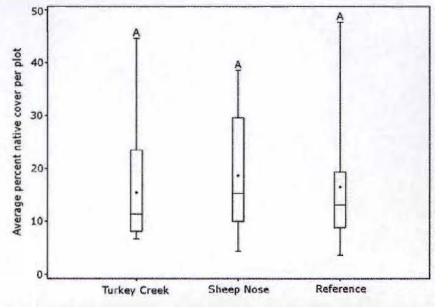
Bottom line: post-fire rehabilitation treatment

- No apparent signs of the post-fire scarification treatment in 2004
- Consequently, the intensity of scarification cannot be determined

Bottom line: natives

Native richness, cover were not affected by fire or by fire+rehab





Bottom line: natives

- 13 dominant native species identified
- Most native dominants were tolerant of the fire (9 total)

Small-leaf pussytoes (*Antennaria parvifolia*)
White sagebrush (*Artemisia ludoviciana*)
Ross' sedge (*Carex rossii*)
Hairy false goldenaster (*Heterotheca villosa*)
Fendler's ragwort (*Packera fendleri*)
Bigflower cinquefoil (*Potentilla fissa*)
Prairie bluebells (*Mertensia lanceolata*)
Mountain muhly (*Muhlenbergia montana*)
Soapweed yucca (*Yucca glauca*)

Bottom line: natives

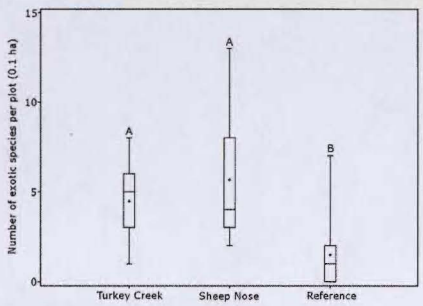
- Stimulated & sensitive species were also found— most were affected by the fire, but not not additionally affected by the rehab treatment

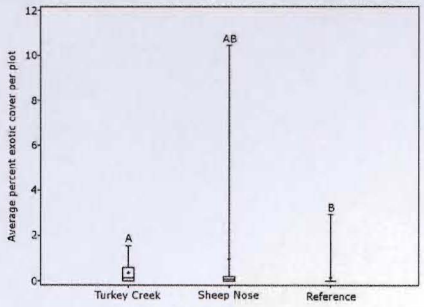
Stimulated:
Fendler's rockcress (*Arabis fendleri*)
Fremont's goosefoot (*Chenopodium fremontii*)
Narrowleaf goosefoot (*Chenopodium leptophyllum*)

Sensitive:
Nodding onion (*Allium cernuum*)

Bottom line: non-natives

Non-native richness, cover were positively affected by fire, but additional effects due to rehab treatment were not found





Bottom line: non-natives

- One dominant non-native: mullein (*Verbascum thapsus*)
- Mullein was stimulated by fire but not by rehab treatment
- Mullein is also considered noxious in Colorado
- Contamination of seed with weedy species is often a concern, but did not seem to be a problem here

What do our findings mean?

- Hayman Fire had some short-term effects on plant community as a whole, and on individual species
- Seed-and-scarify rehab treatment had little additional effect

What do our findings mean?

However:

- Rehab treatment intensity was low
- Hayman BAER treatment did not significantly affect erosion rates (L. MacDonald, pers comm)

Do BAER treatments increase veg cover compared to the untreated condition? Do they reduce erosion?

Relatively few studies available; focus on seeding only

Postfire Year 1:

-47% of studies showed seeding increased cover

-13% of studies showed seeding cover reduced erosion

Postfire Year 2:

-44% of studies showed seeding increased cover

-22% of studies showed seeding cover reduced erosion

Robichaud et al 2000

How do BAER treatments affect understory recovery?

- Successful establishment of seeded grasses displaces natives— particularly annuals
- Tree seedling establishment can also be inhibited
- Shrubs, perennial sprouters not usually affected

Manager's dilemma: If seeding is successful at erosion control, native plant establishment will probably be negatively impacted

Beyers 2004

Conclusions/ recommendations

- My results indicate that seed-and-scarify treatment did not affect understory in the Hayman Fire
- But it also did not affect erosion rates!
- However, seed-and-scarify treatment has not been widely used, so its general effects/ effectiveness are unknown
- If seed-and-scarify rehab treatment is used elsewhere, further monitoring/ research is needed

Conclusions/ recommendations

- Much more work has been done on seeding-only treatments
- Both the effectiveness at erosion control and (therefore) the effects on native species are highly variable
  - -Ecosystem burned
  - -Timing of burn
  - -Precipitation following the burn
  - -Nature of the terrain burned
- Continued monitoring/research is needed, especially in areas where little information is available

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