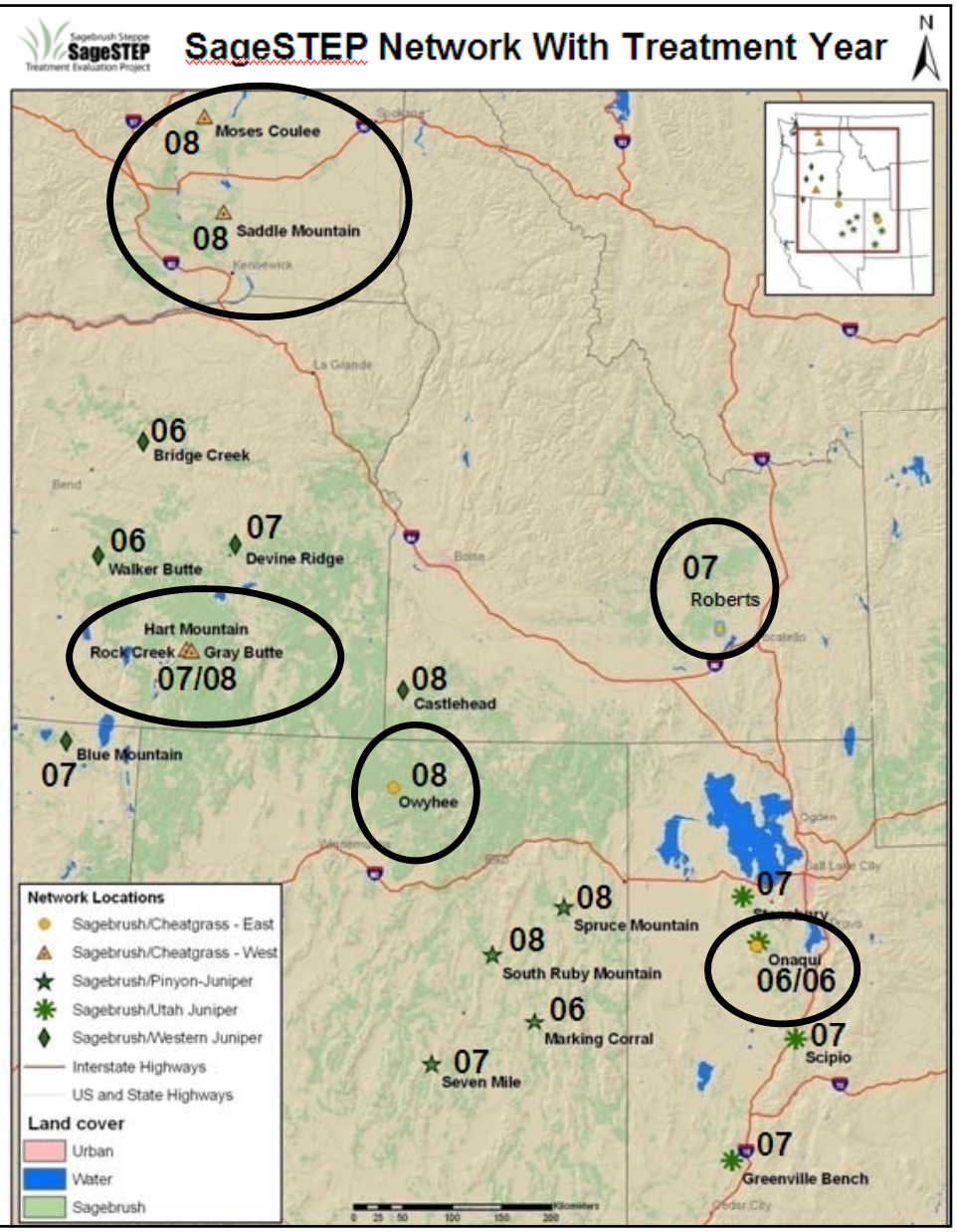
SageSTEP Site Overview

- 20 sites within network
- 7 within the sagebrush/cheatgrass network
- 13 sites within the juniper encroachment network

= sagebrush/ cheatgrass network sites



Overview

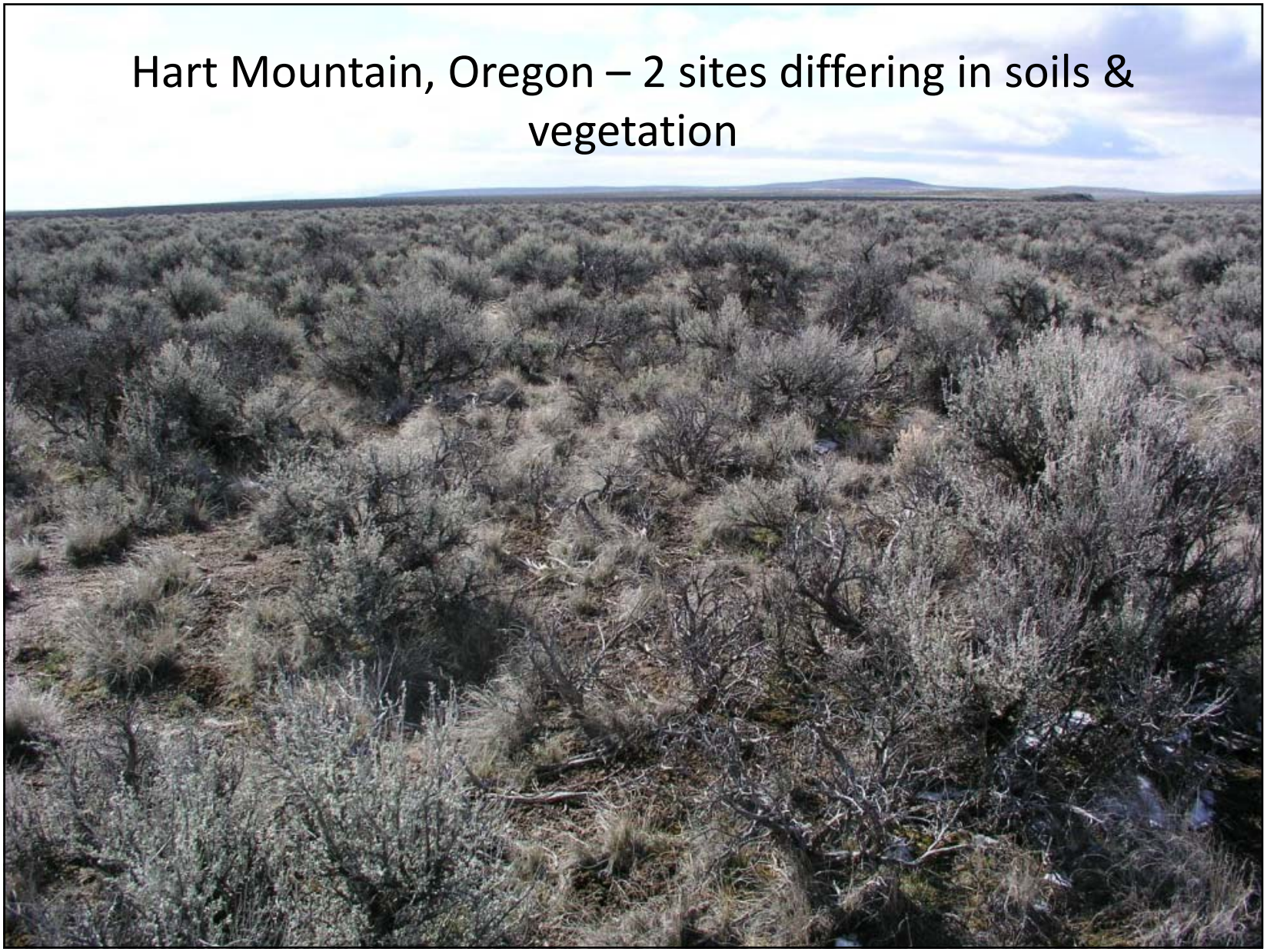
- Multi-institution, multi-disciplinary experimental study of fuels treatment effects in the endangered sagebrush ecosystem
- Plants, fuels, birds, insects, soils, hydrology, economics, and social aspects

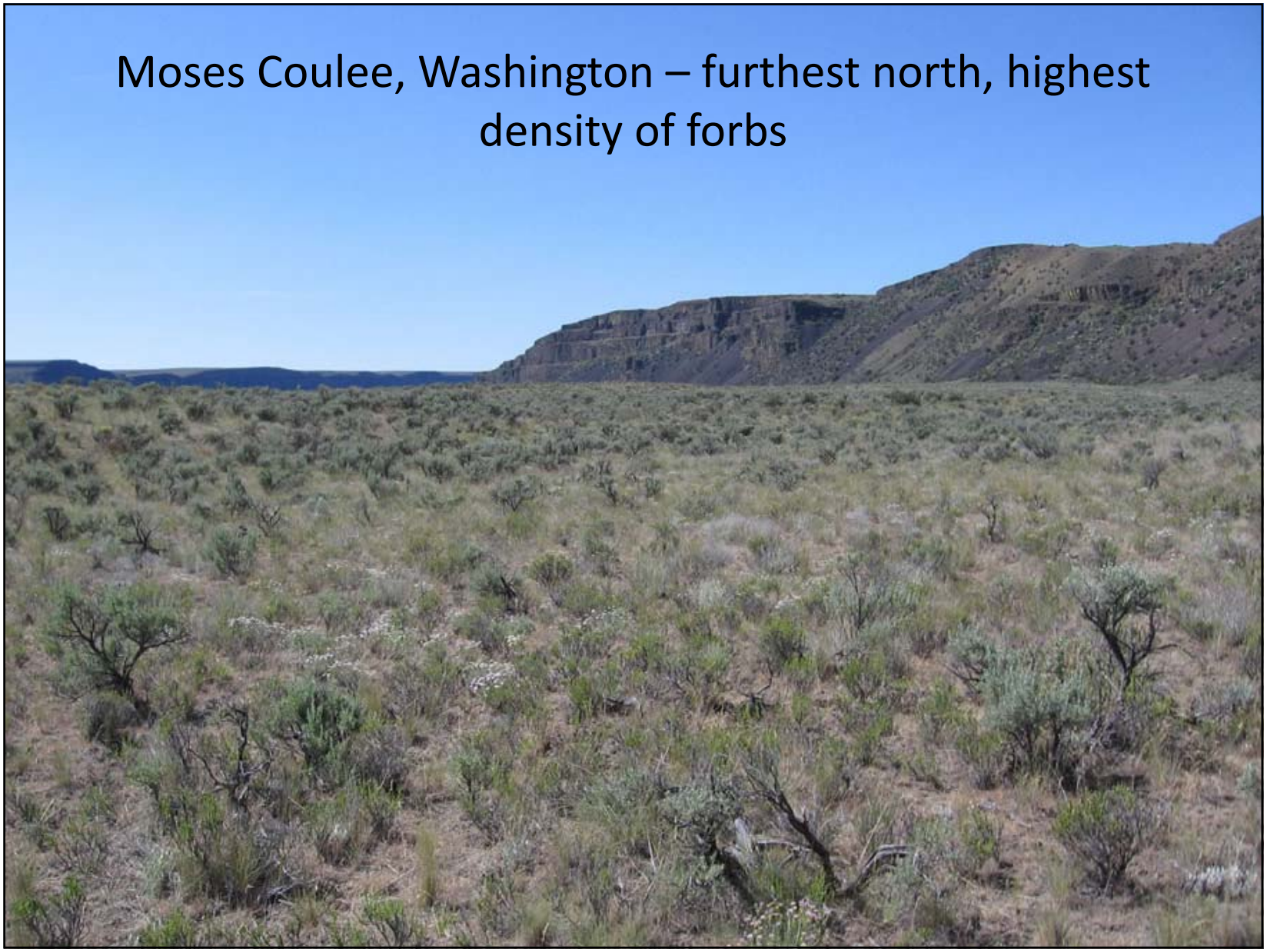
Here we are concerned with vegetation responses to fuels treatments in the sagebrush/cheatgrass network

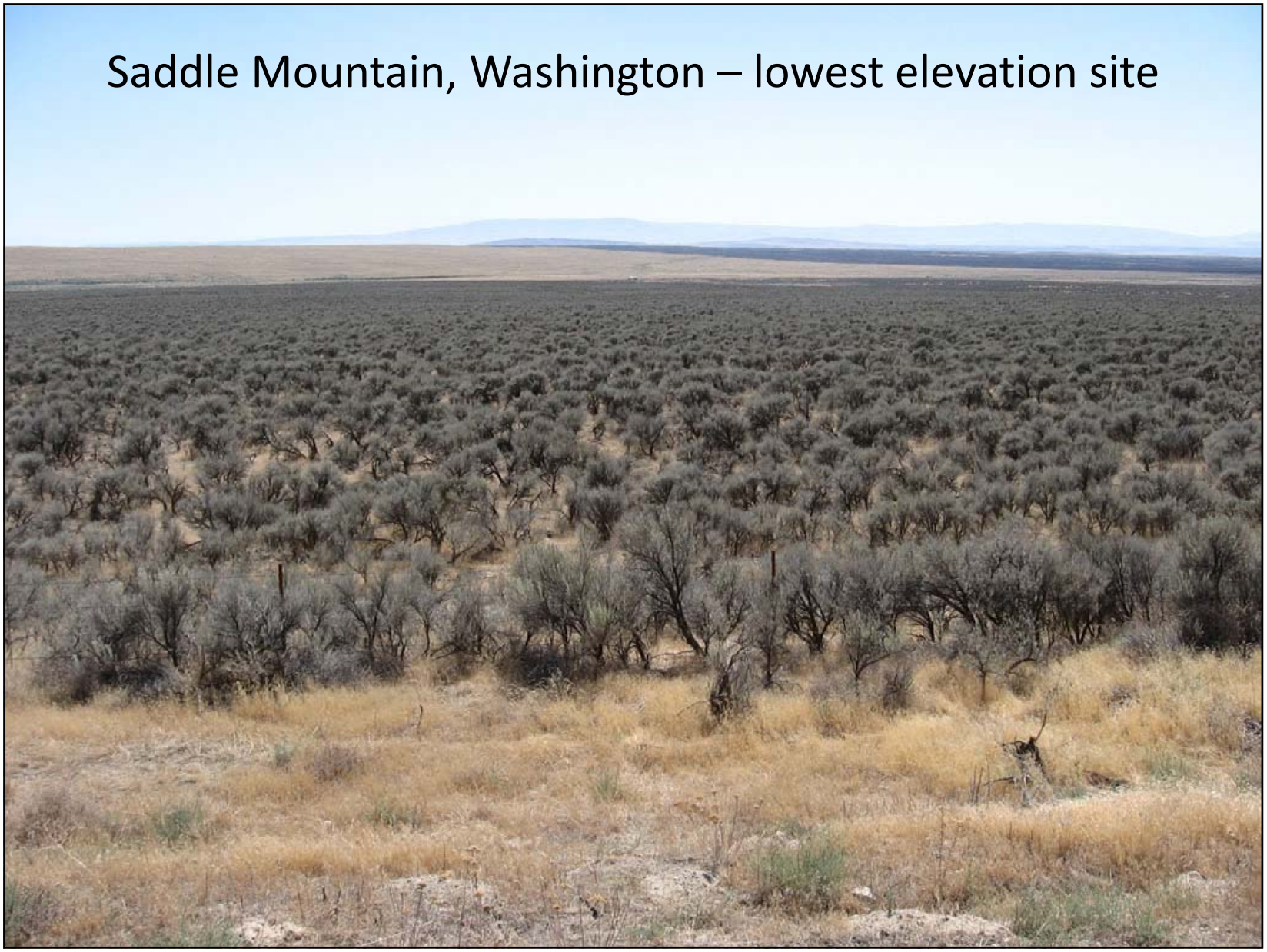
First three years post-treatment

Fuels treatments

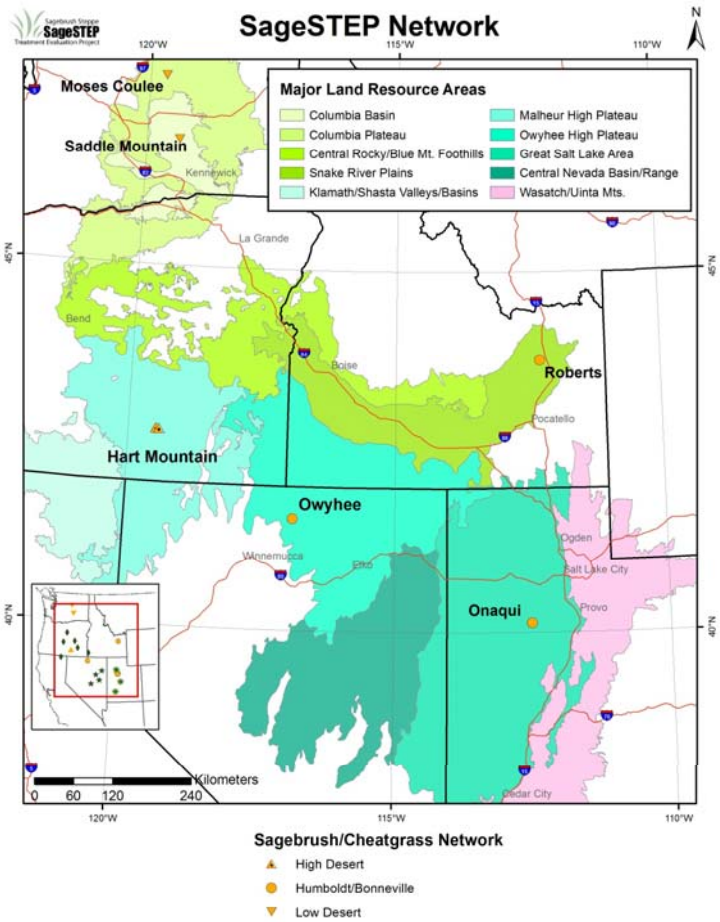
- Whole plot level (75-200 acres)
  - Control – un-manipulated
  - Burn – fall prescribed fire – goal 100% black
  - Mow – 8”-12” mower height – goal of mechanically reducing sagebrush cover ≈ 50%
  - Tebuthiuron (Spike) – 1.5 lbs/acre via fixed wing – goal of chemically reducing sagebrush cover ≈ 50%
- Subplot level (0.25 acres)
  - Imazapic (Plateau) pre-emergent herbicide – ≈ 6 oz/acre


Hart Mountain, Oregon – 2 sites differing in soils & vegetation


Moses Coulee, Washington – furthest north, highest density of forbs

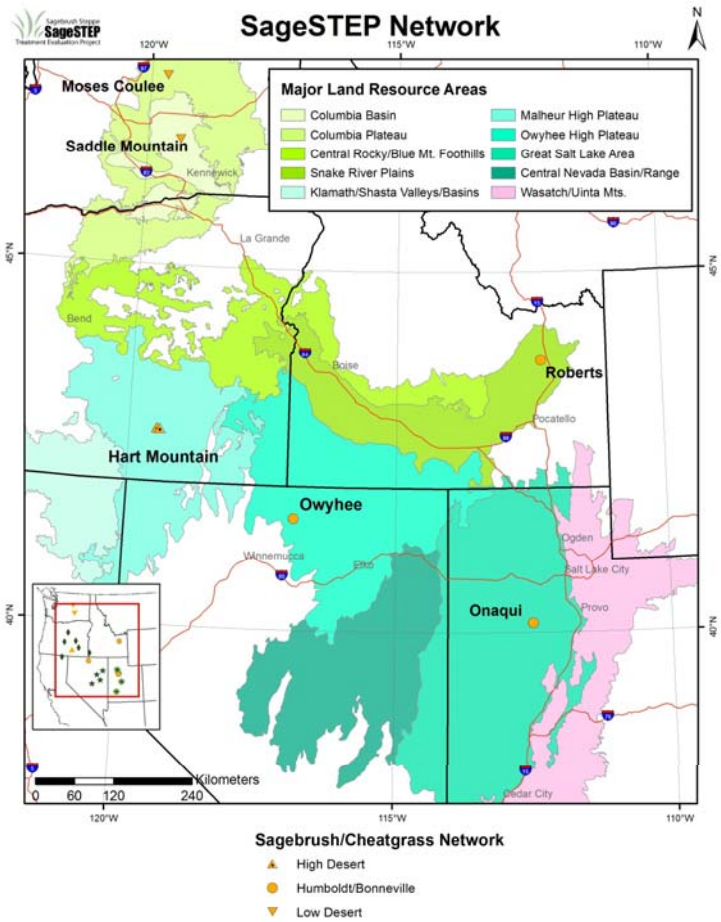

Saddle Mountain, Washington – lowest elevation site

Site comparisons



- The 7 sites are spread across 6 MLRAs
- Onaqui is on a calcareous substrate, the rest on basalt
- But there are still differences in soil depth, texture, and fertility
- Vary in Climate

Site comparisons



- Grazing is excluded from all plots, but they differ greatly in grazing history
  - Owyhee – year-round cattle grazing
  - Roberts – winter & spring sheep grazing
  - Hart Mountain – pronghorn refuge

Widespread species

SPECIES	Relative Frequency at each Site (%)								
	GB (OR)	MO (WA)	ON (UT)	OW (NV)	RC (OR)	RO (ID)	SD (WA)	Indicator value	Nativity/ Form
Artemisia tridentata ssp. *wyomingesis* *(Wyoming big sagebrush)*	100	100	100	100	100	100	100	17.7	Nat. Shrub
Elymus elymoides (Squirreltail)	100	13	99	97	99	95	6	26.4	Nat. Per. Grass
Poa secunda (Sandberg's bluegrass)	43	100	100	95	93	52	100	30	Nat. Per. Grass

- Relative frequency is % subplots with species
- Lower indicator values mean species is well-represented across sites and subplots within sites

Localized species

SPECIES	Relative Frequency at each Site (%)							Indicator value	Nativity/ Form
	GB (OR)	MO (WA)	ON (UT)	OW (NV)	RC (OR)	RO (ID)	SD (WA)		
Hesperostipa comata (Needle and Thread grass)	0	57	0	0	0	79	0	46.2	Nat. Per. Grass
Vulpia octoflora (Sixweeks fescue)	0	86	0	0	0	1	54	61.9	Nat. Ann. Grass
Atriplex confertifolia (Shadscale saltbush)	0	0	65	0	0	0	0	64.6	Nat. Shrub
Pseudoroegneria spicata (Bluebunch wheatgrass)	0	71	2	0	0	0	94	65.8	Nat. Per. Grass

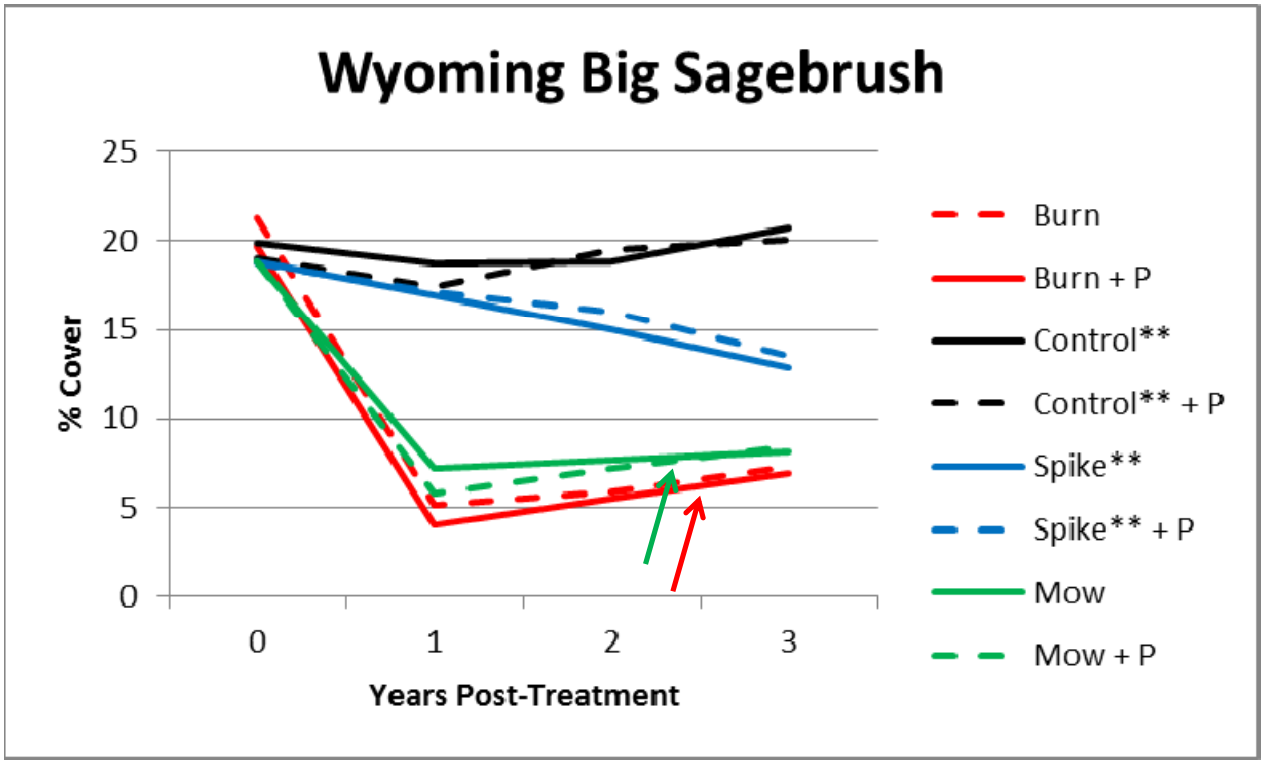
- Relative frequency is % subplots with species
- Lower indicator values mean species is well-represented across sites and subplots within sites

Variation across sites

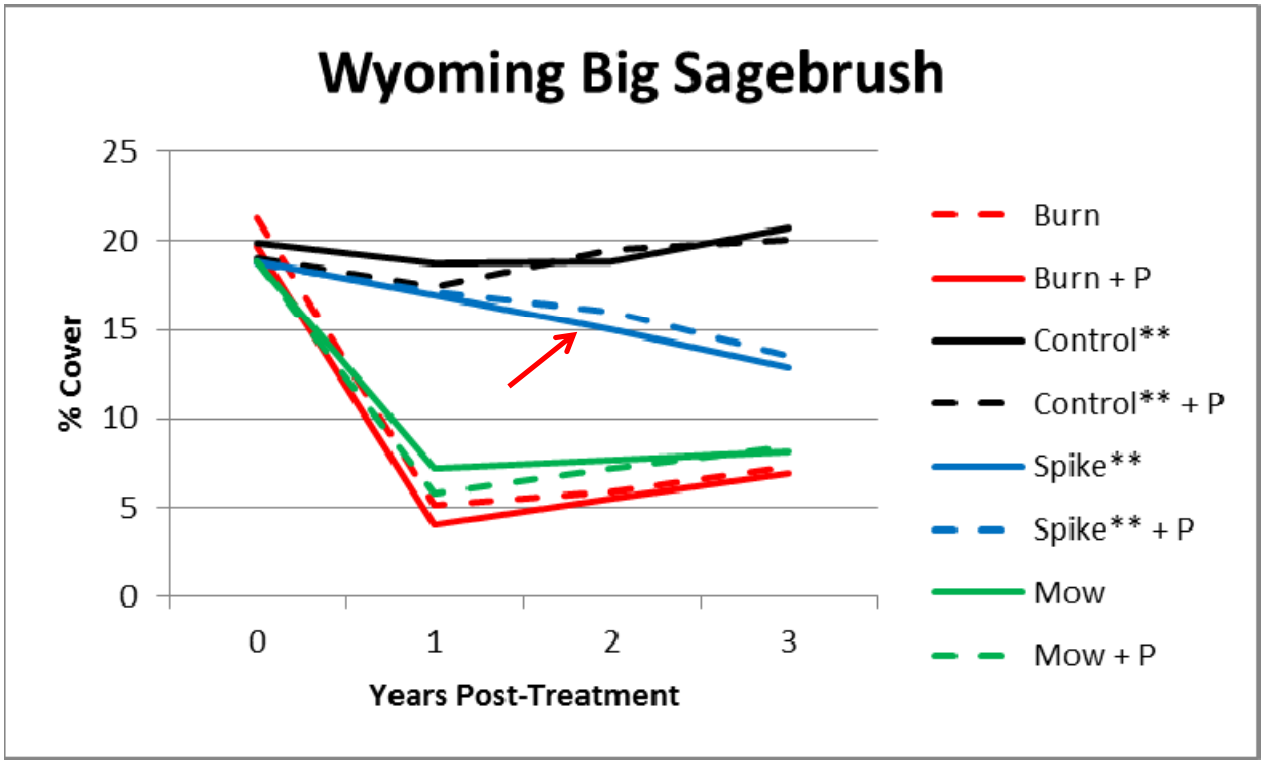
- Mean precipitation & elevation are correlated
- Sandberg's bluegrass is negatively correlated with above
- Cheatgrass is negatively correlated with sagebrush and soil carbon
- Analysis suggests there is strong biological and environmental overlap between the sites
- 2 Washington sites are somewhat distinct in their Sandberg's abundance

Did the fuel treatments result in this …

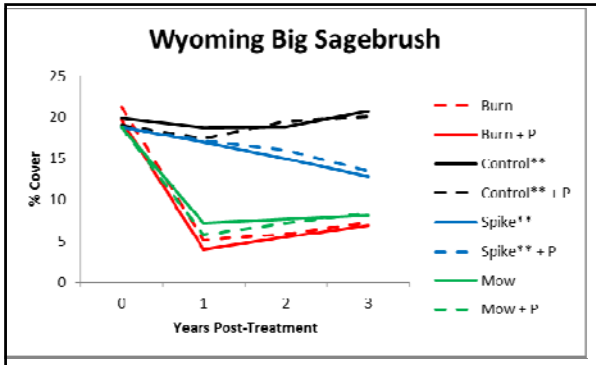
or result in this…



- Burn & mow treatments had significantly less cover than other treatments in all post-treatment years
- Mowing killed fewer sagebrush, though

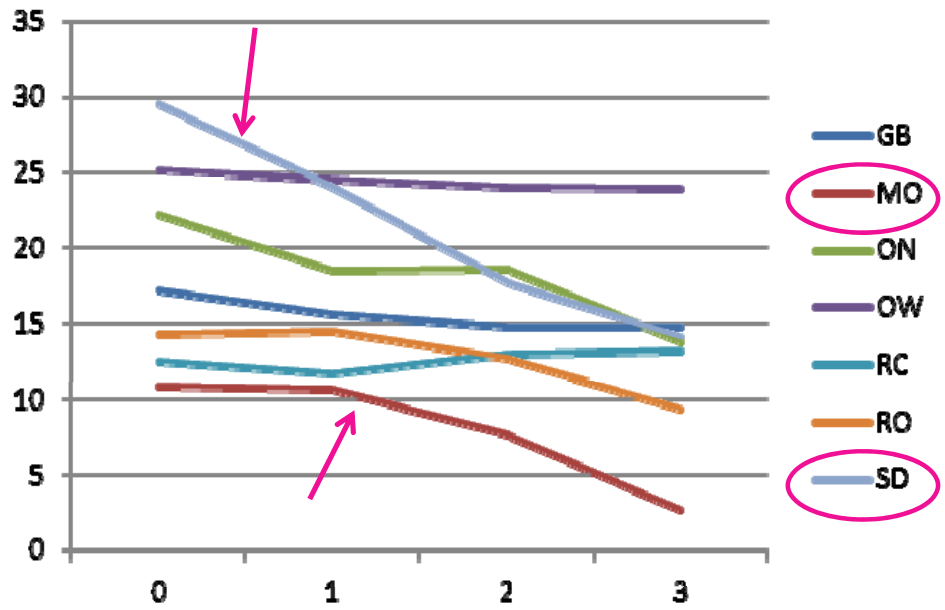


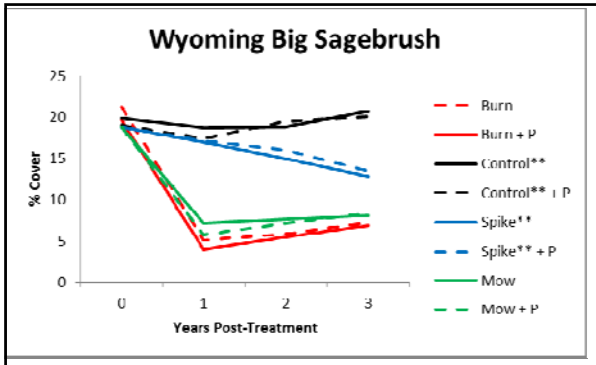
- Tebuthiuron: reduction was subtle, did not achieve the 50% target (yet)…



Tebuthiuron plot, sagebrush cover by site

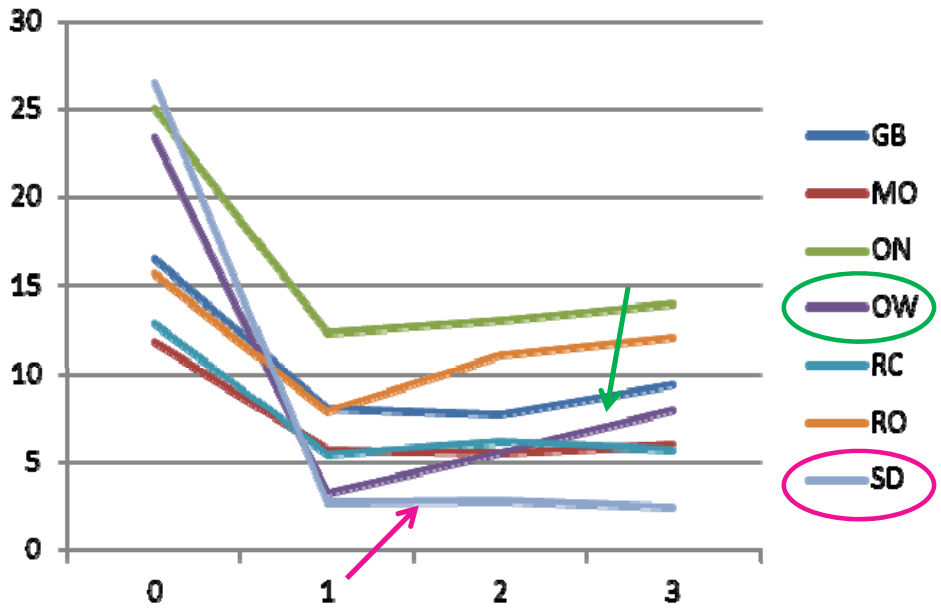
- And was driven primarily by the Washington sites

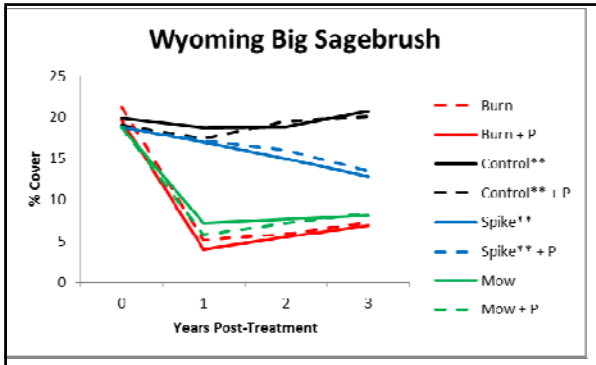




Mow plot,
sagebrush cover by site

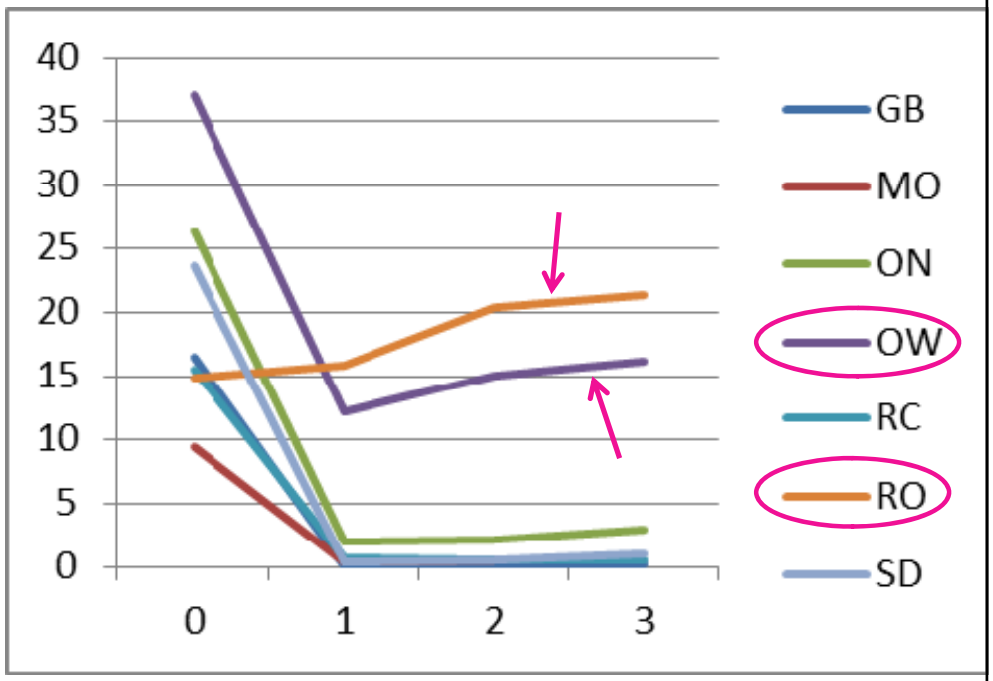
- Overall, ≈ 60% reduction
- Owyhee & Saddle Mt. had greatest reduction
- Owyhee is recovering more rapidly

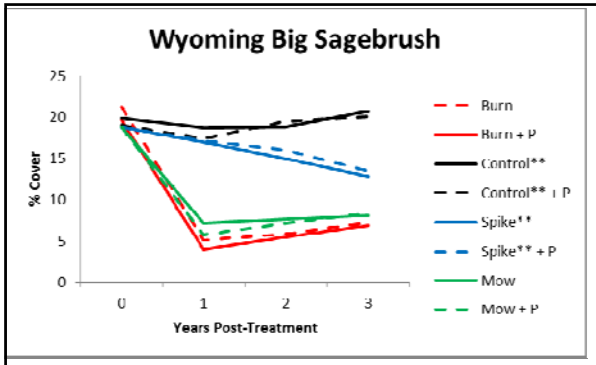




Burn plot,
sagebrush cover by site

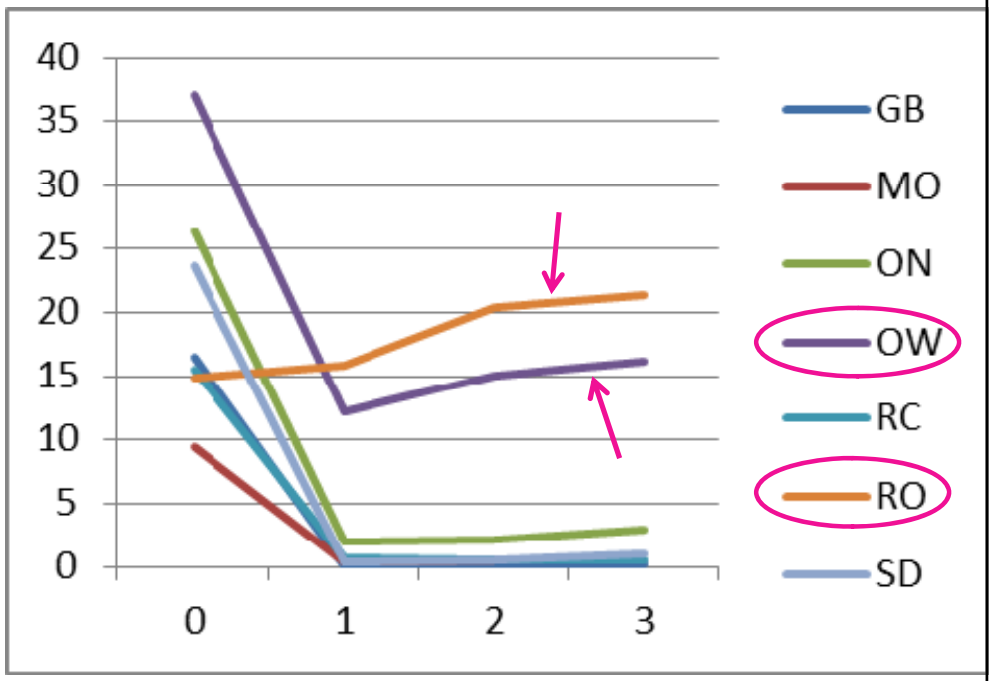
- Except for Owyhee & Roberts mortality was substantial

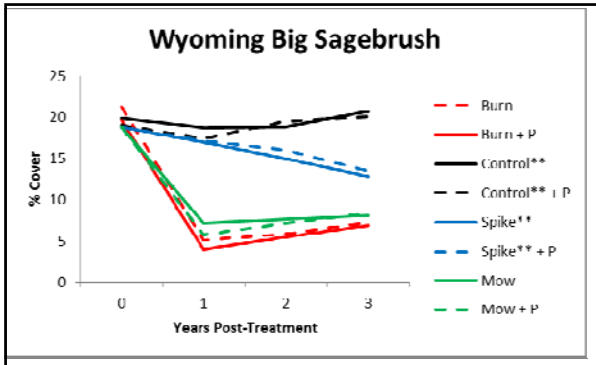




Burn plot,
sagebrush cover by site

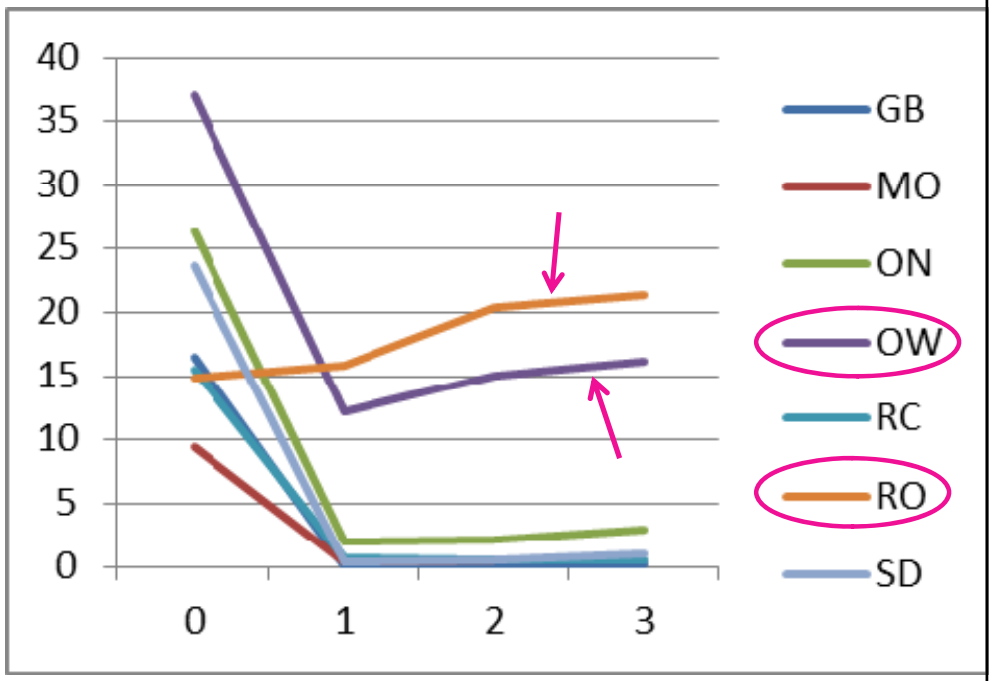
- Owyhee was patchy, with well-burned areas and un-burned areas

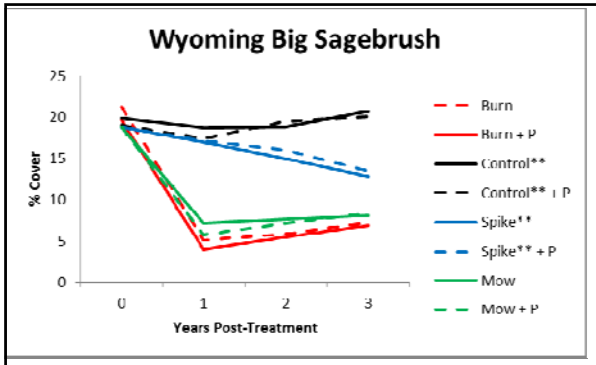




Burn plot,
sagebrush cover by site

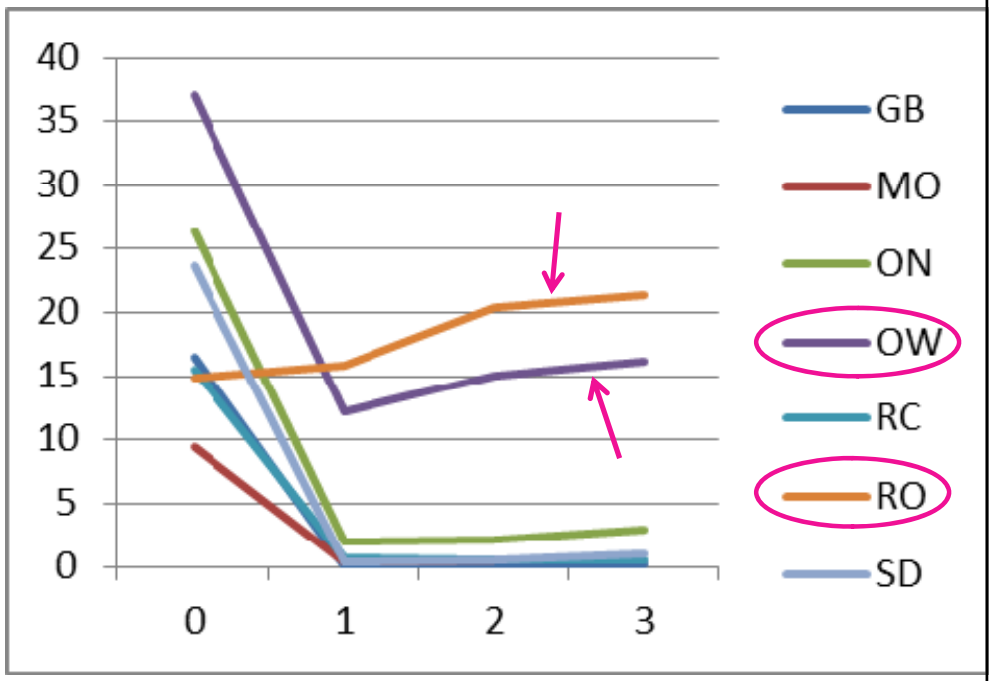
- Roberts was uniformly lightly-burned
  - Fuel was more patchy and could not carry the fire well

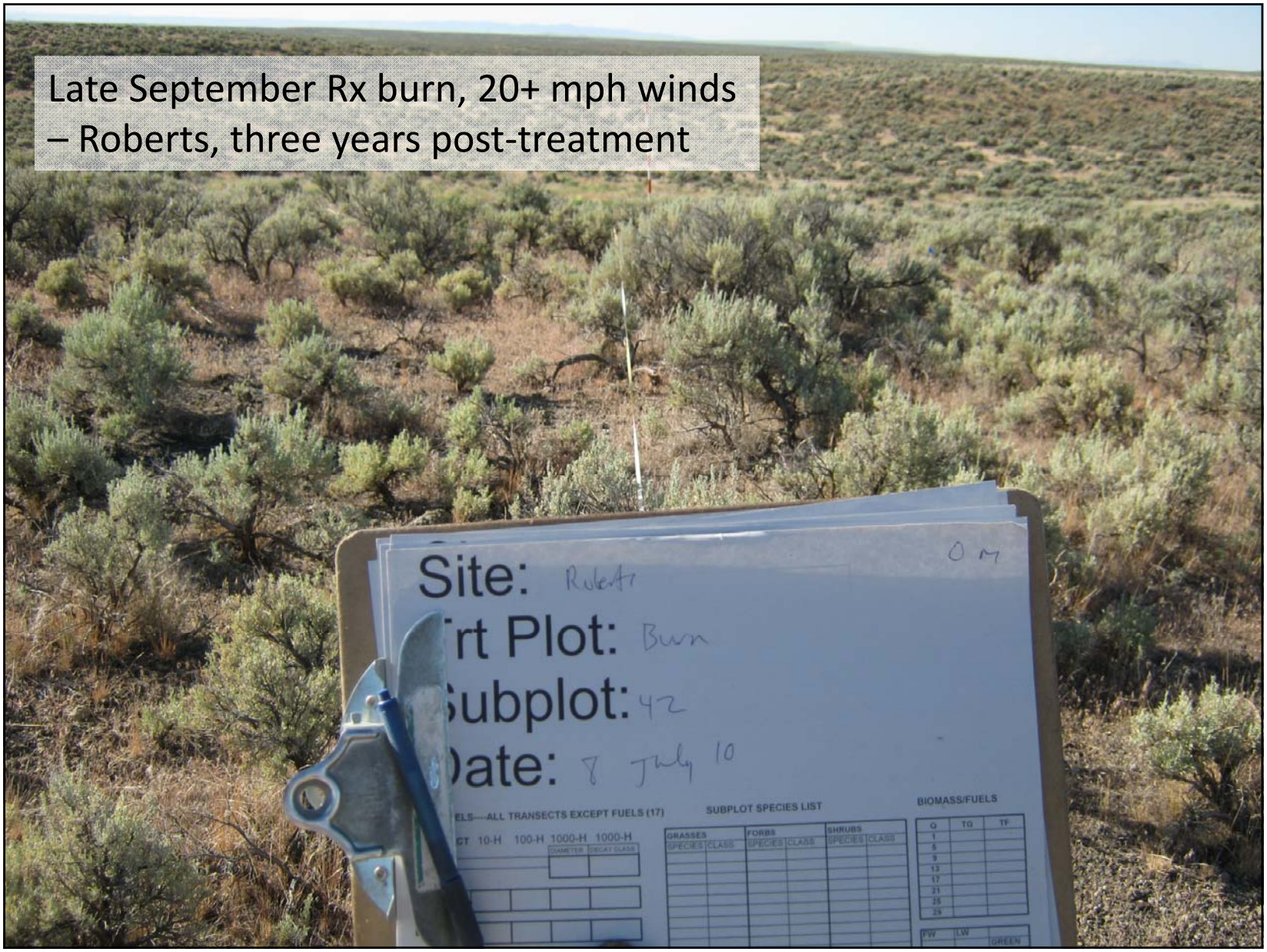




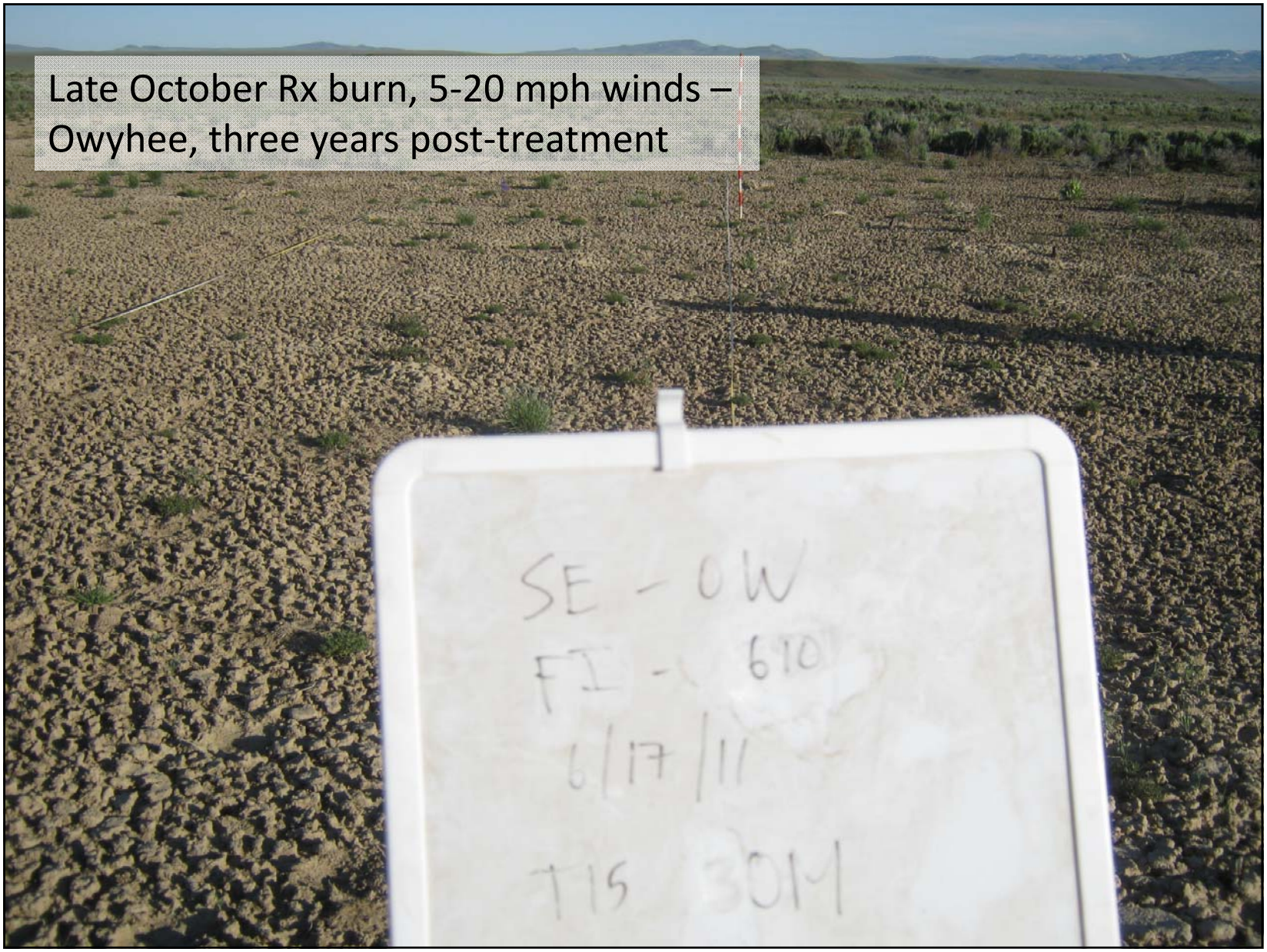
Burn plot,
sagebrush cover by site

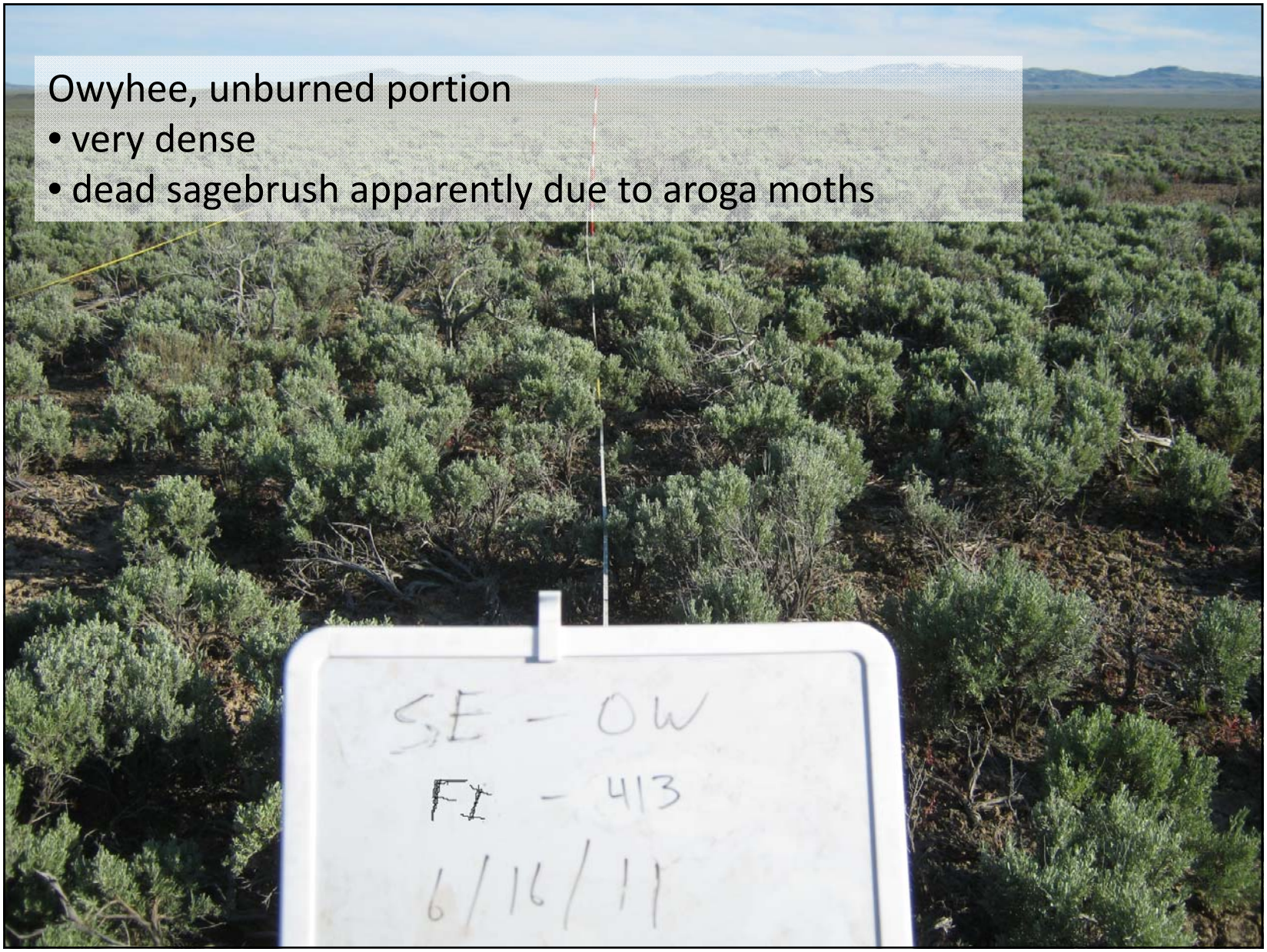
- But with strong winds in summer, anything can burn, which happened to Roberts in 2010 in the Jefferson fire



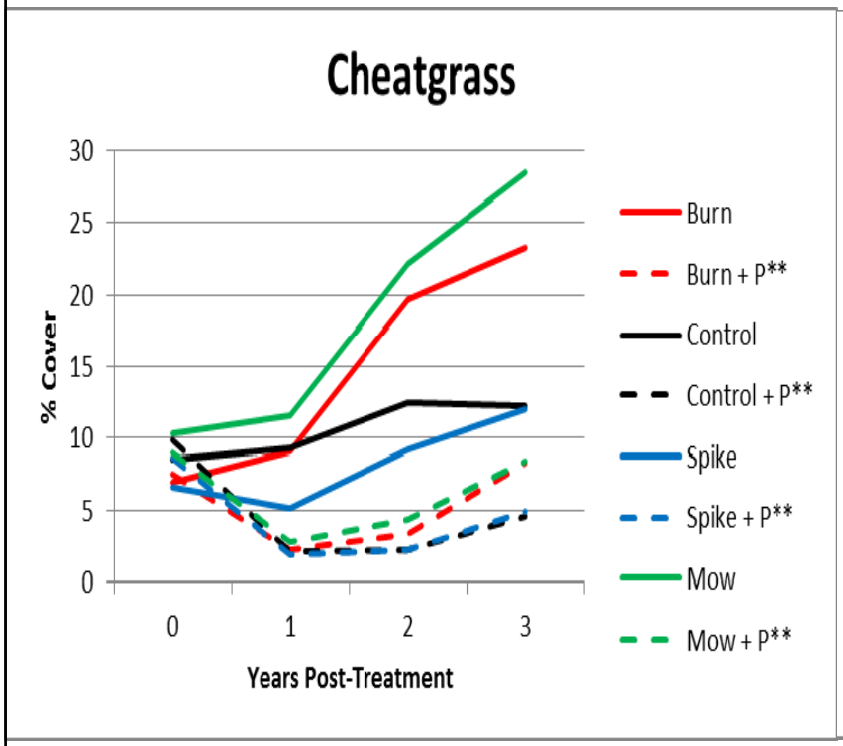

Late September Rx burn, 20+ mph winds
– Roberts, three years post-treatment
Site:
Plot:
Subplot:
Date:
SUBPLOT SPECIES LIST
BIOMASS/FUELS

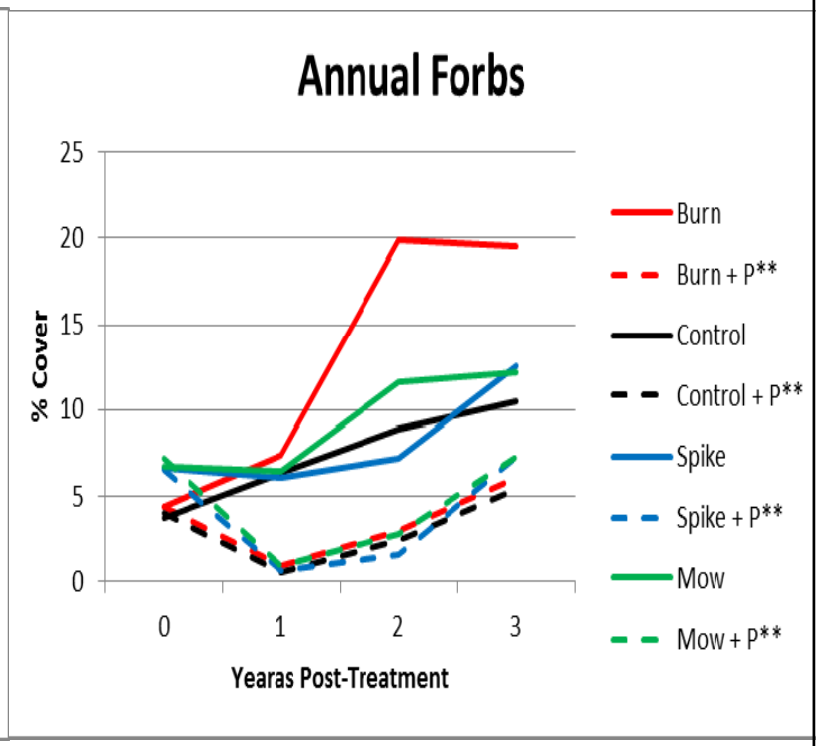
Owyhee burn making a run


Late October Rx burn, 5-20 mph winds –
Owyhee, three years post-treatment
SE - OW
FI - 610
6/17/11
T15 30M

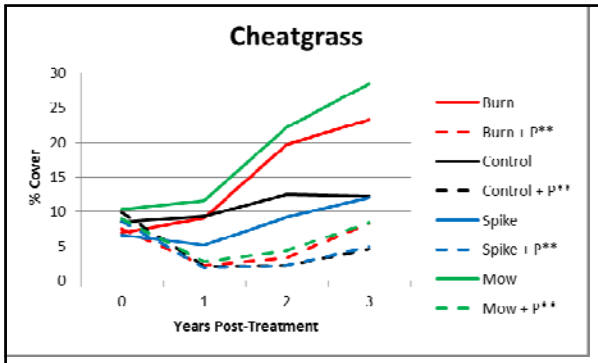


Owyhee, unburned portion
- very dense
- dead sagebrush apparently due to aroga moths



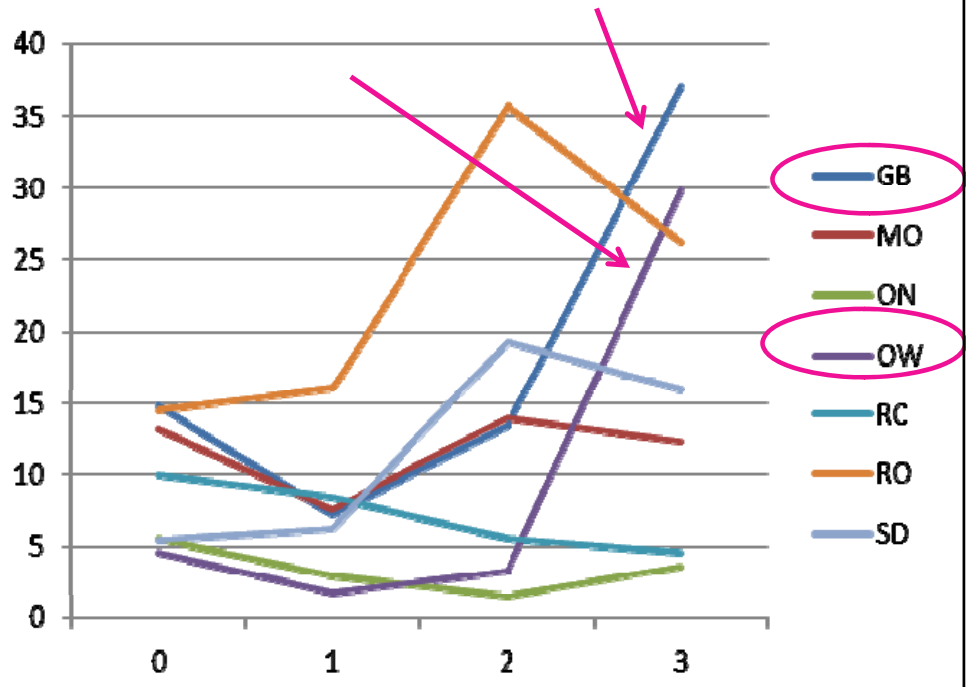


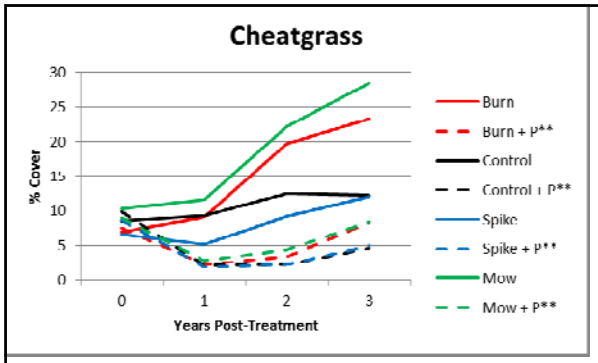
- Cover was significantly lower in imazapic than in non-imazapic subplots in all post-treatment years
- Increase following treatment, especially in Burn & Mow, but increase was delayed with imazapic



Mow plot,
cheatgrass cover by site

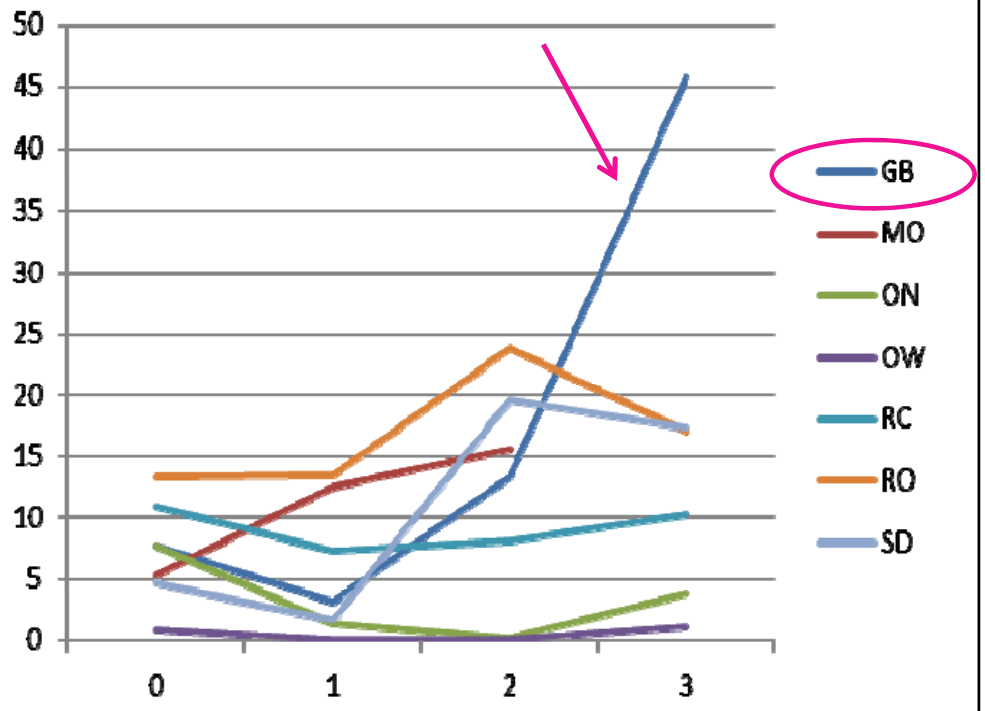
- Large increases in cheatgrass in mow plots following treatment at Gray Butte and Owyhee

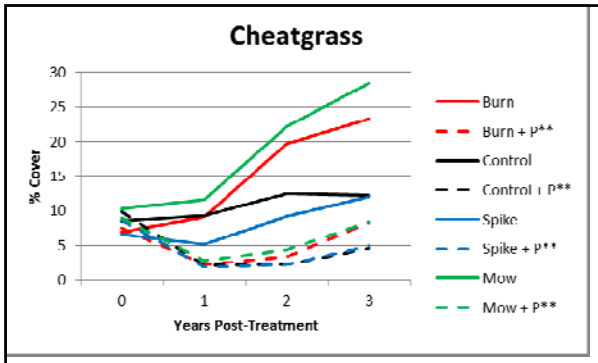




Burn plot,
cheatgrass cover by site

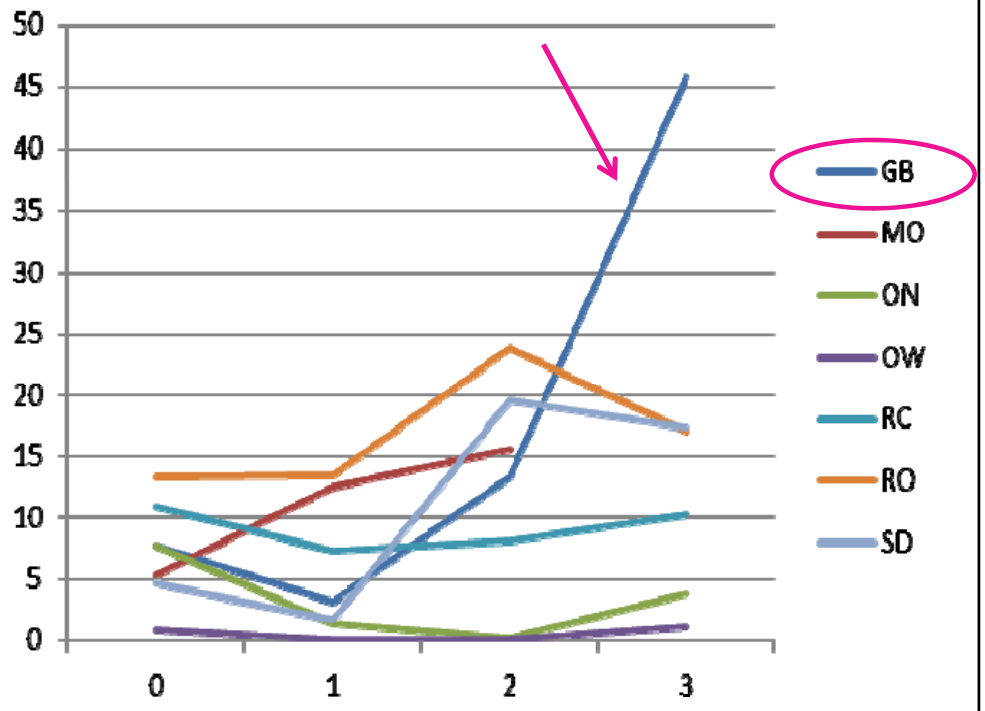
- Gray Butte also had a large increase in Tebuthiuron (not shown) and Burn plots

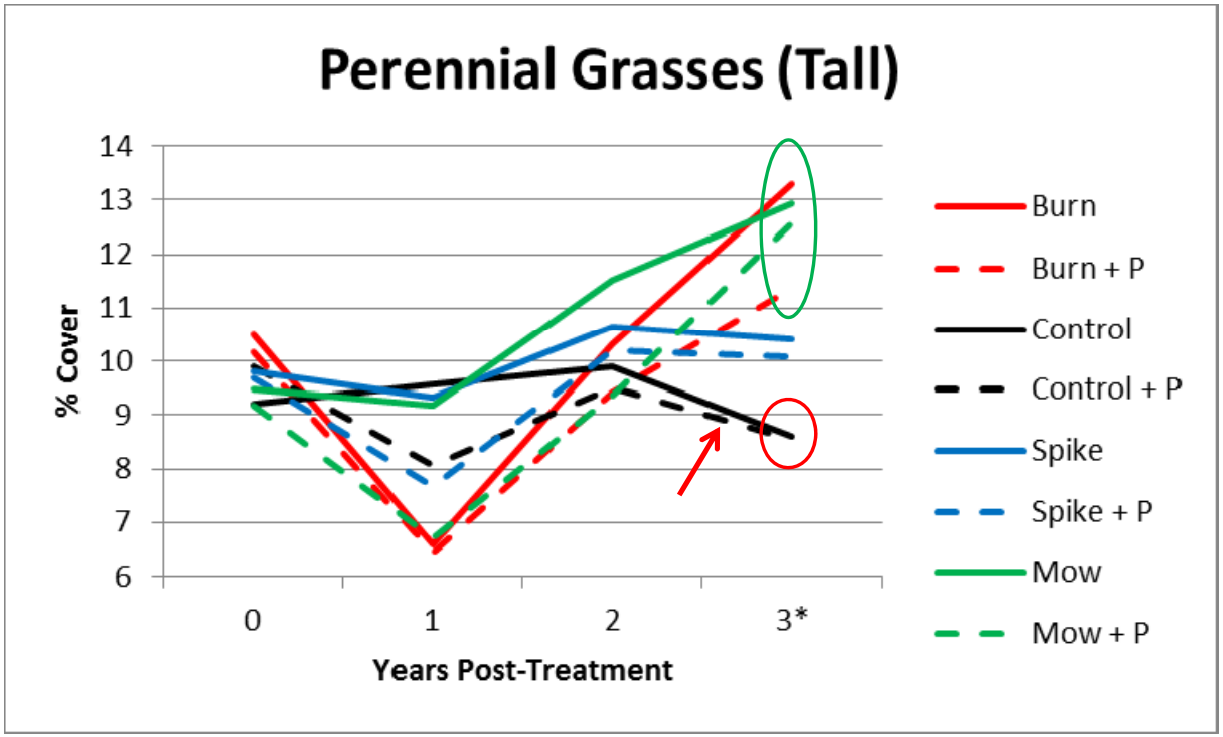




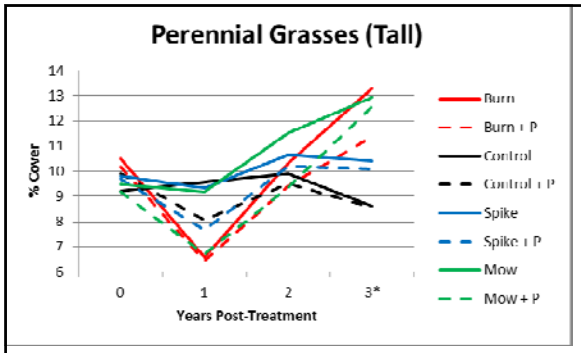
Burn plot,
cheatgrass cover by site

- This is just three years, however
- Onaqui is now 5-yr post-treatment and exotic annual grass & forb cover is starting to increase more rapidly



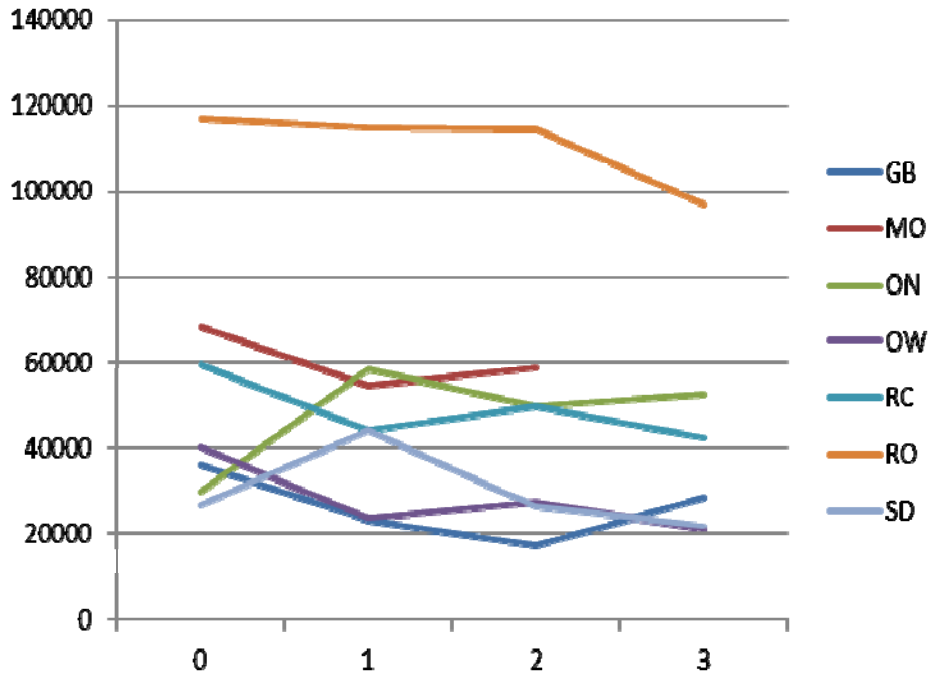


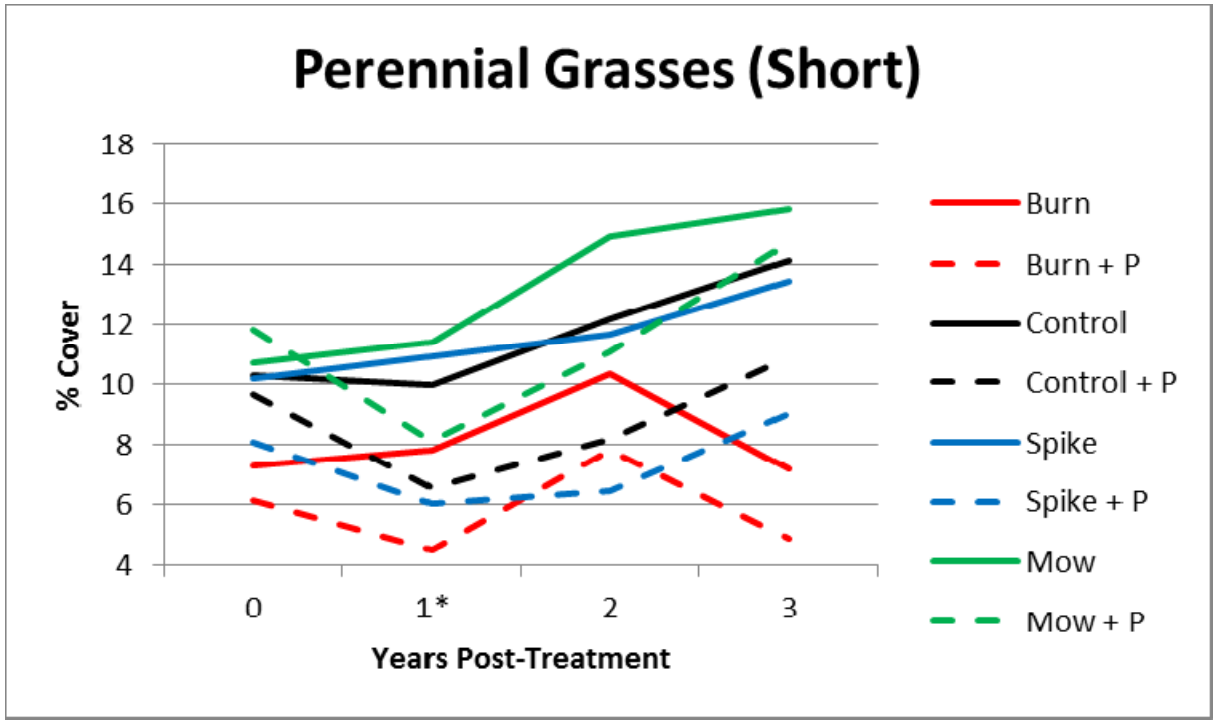
- At year 3, control was marginally significantly lower than other treatments
- Driven mostly by strong increase in Burn & Mow



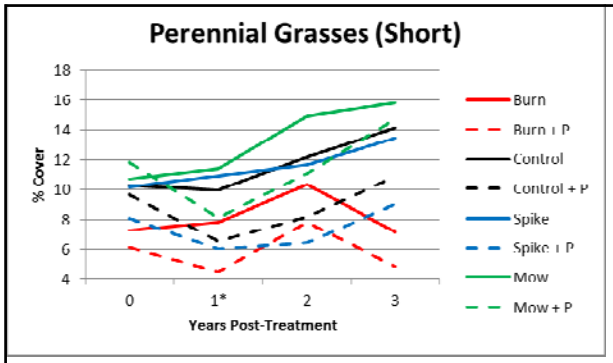
Burn plot perennial grass density/ha

- Cover increase due to growth, not to an increase in density



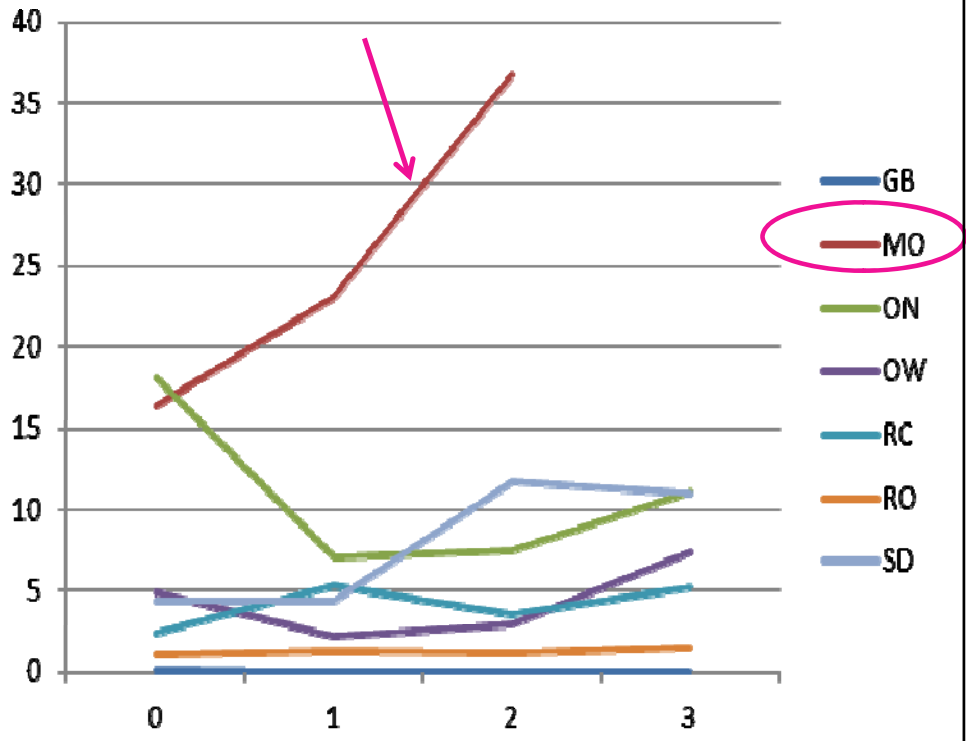


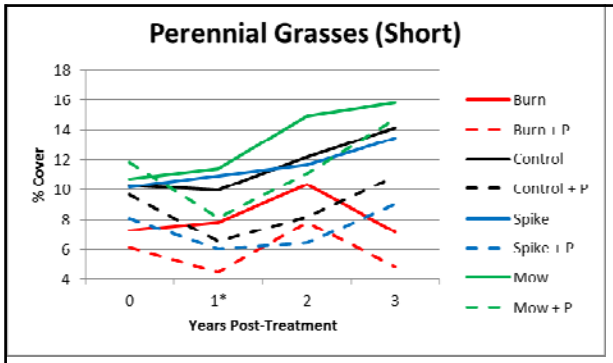
- Cover reduced in Imazapic treatment, but recovered



Burn plot short grass cover

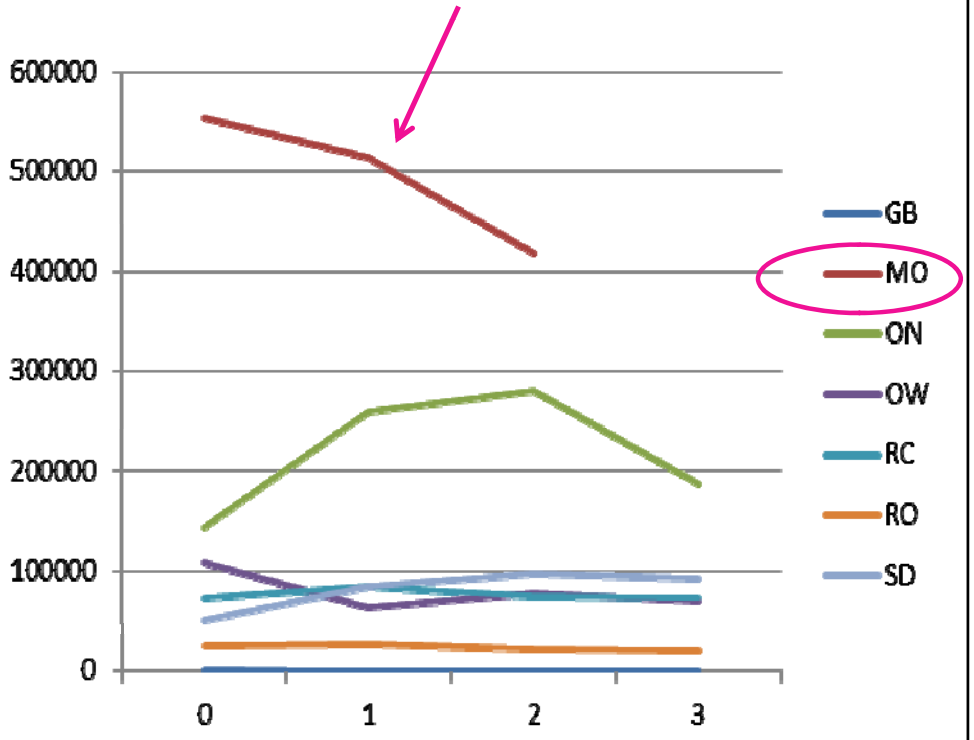
- Generally cover in burn plots did not change or decreased
- At Moses Coulee, a large increase in cover following treatment

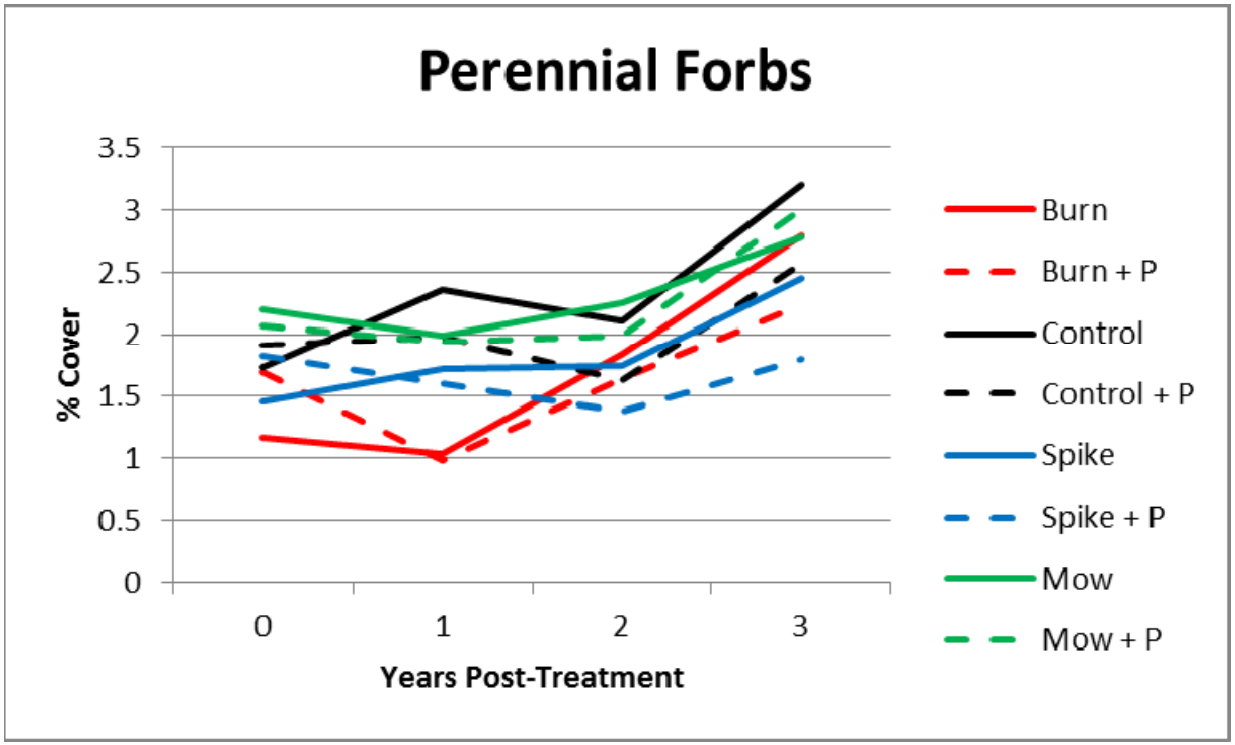




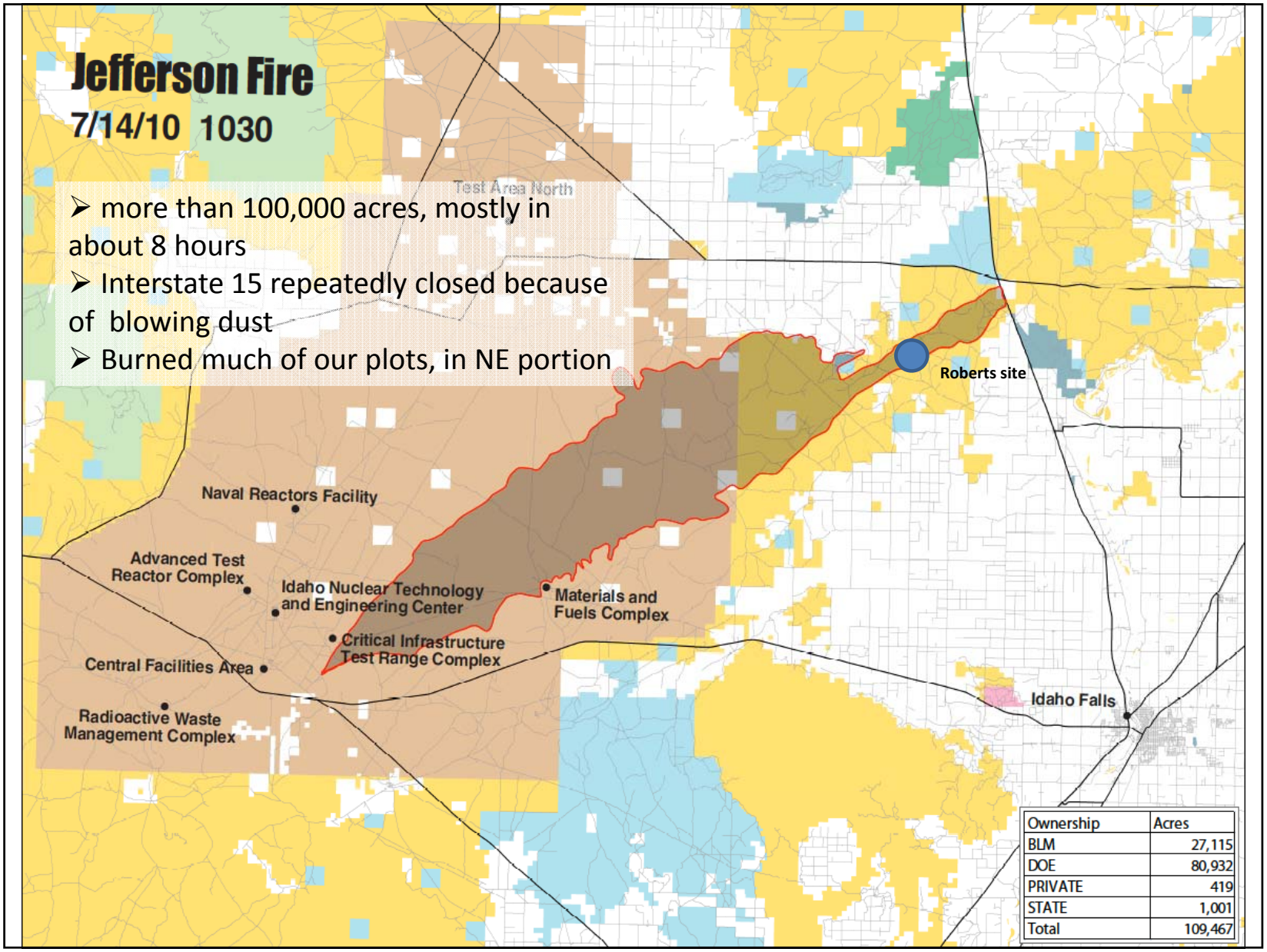
Burn plot short grass density/ha

- Again the increased cover was due to growth
- Density actually decreased





- The small 3rd-year increase is due to a strong positive response at *one* of the Hart Mountain (Oregon) sites
- No apparent Imazapic impact



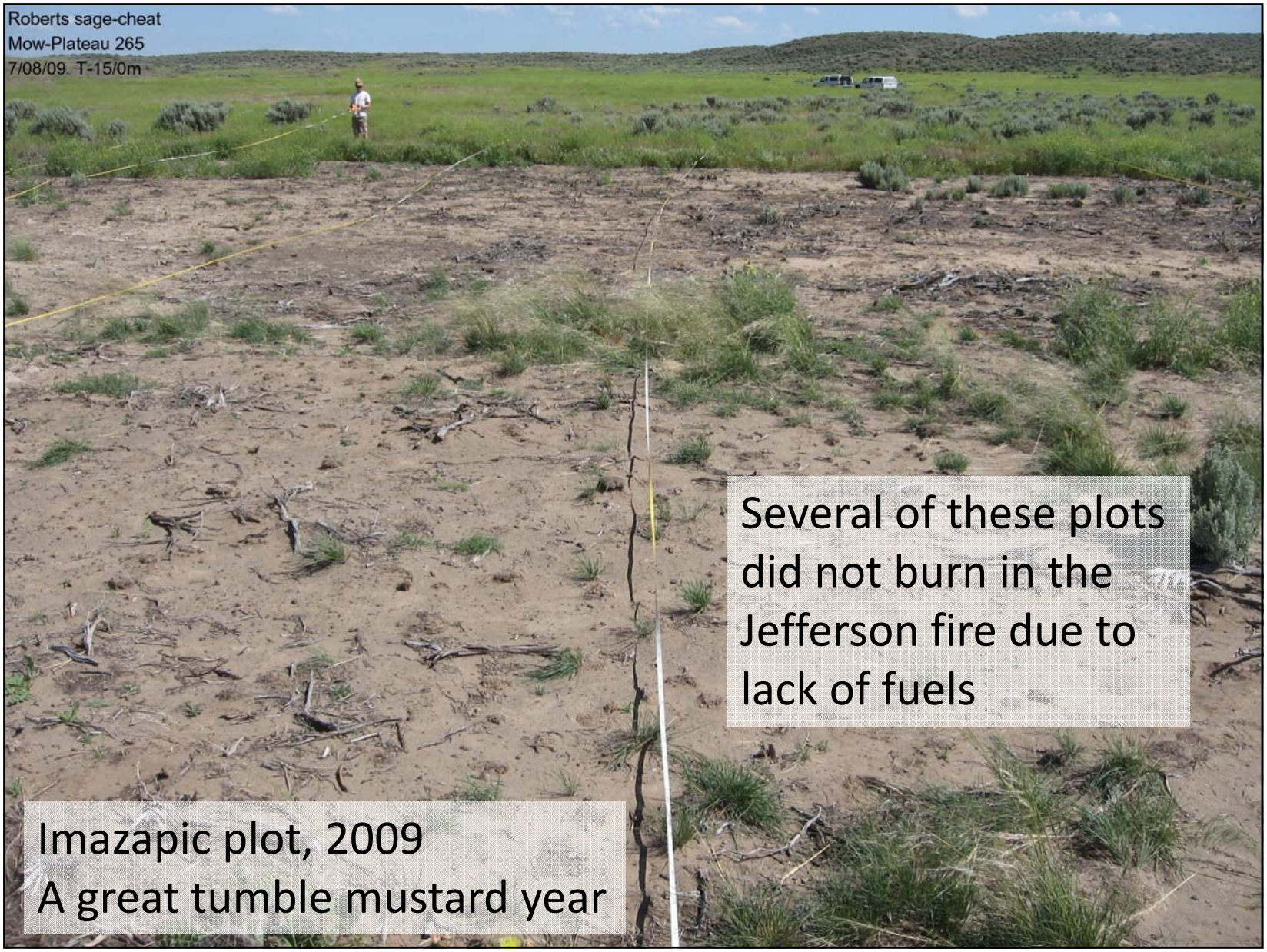
- more than 100,000 acres, mostly in about 8 hours
- Interstate 15 repeatedly closed because of blowing dust
- Burned much of our plots, in NE portion

Ownership	Acres
BLM	27,115
DOE	80,932
PRIVATE	419
STATE	1,001
Total	109,467

Roberts, immediately after the burn

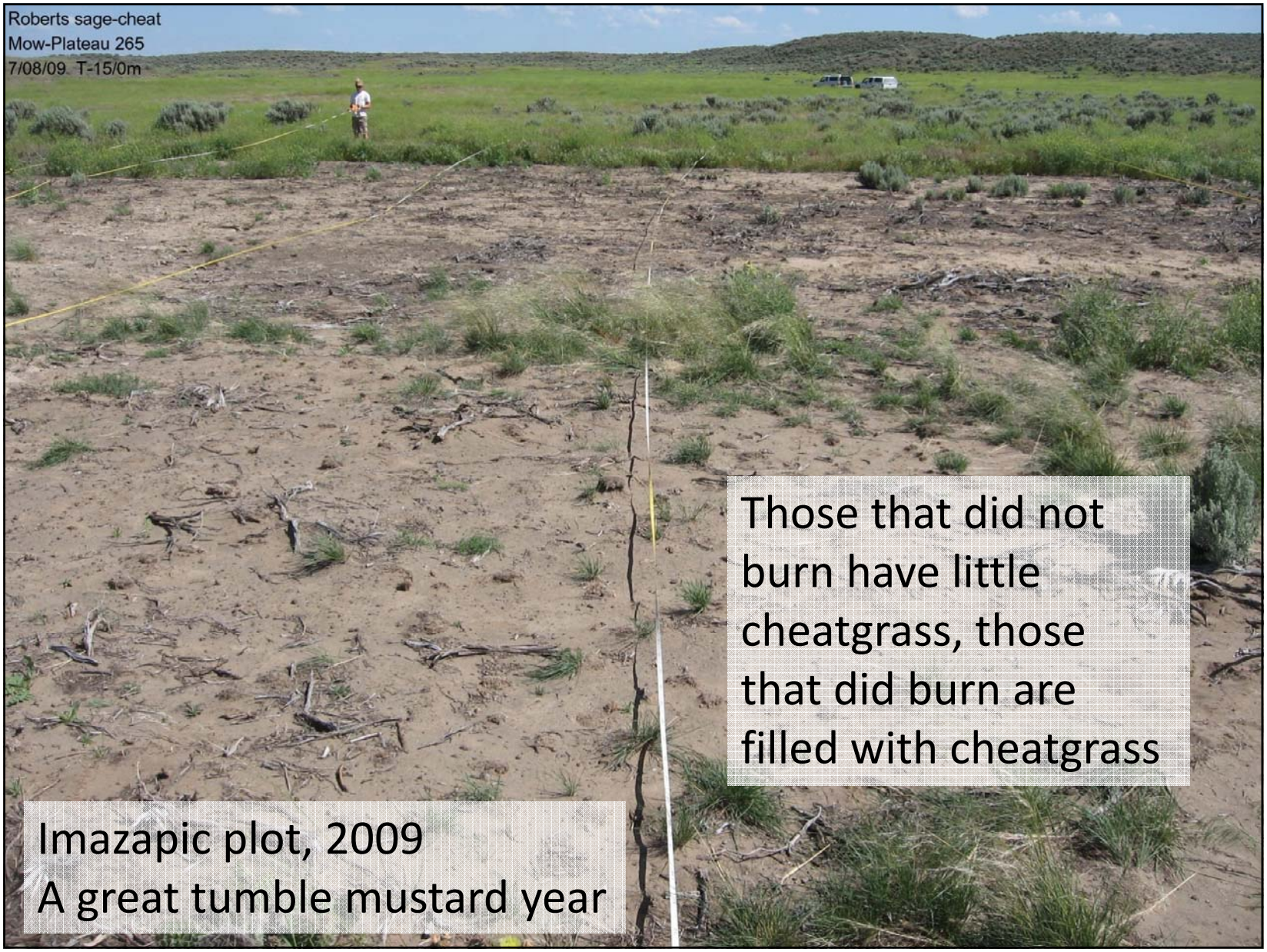
No Imazapic plot, 2009
A great tumble mustard year

Imazapic plot, 2009
A great tumble mustard year



Several of these plots did not burn in the Jefferson fire due to lack of fuels

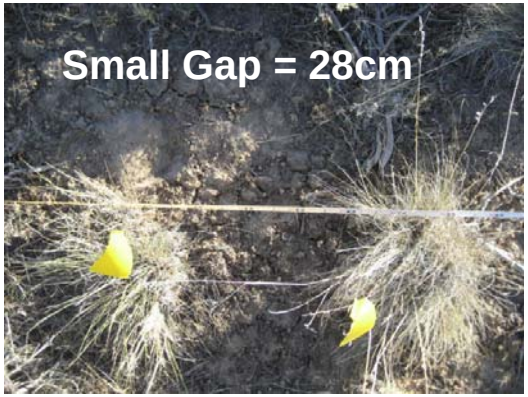
Imazapic plot, 2009
A great tumble mustard year

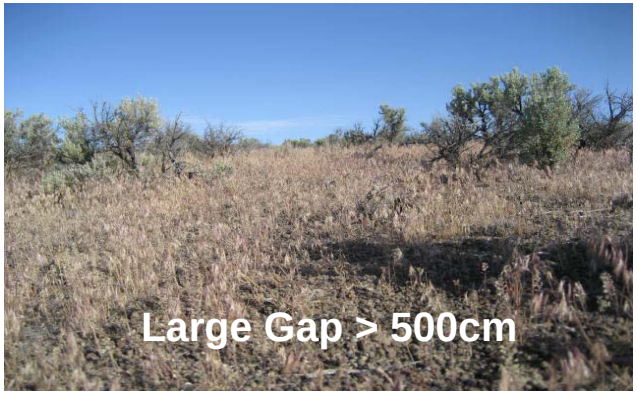


Those that did not burn have little cheatgrass, those that did burn are filled with cheatgrass

Imazapic plot, 2009
A great tumble mustard year

Inter-perennial Plant Gaps





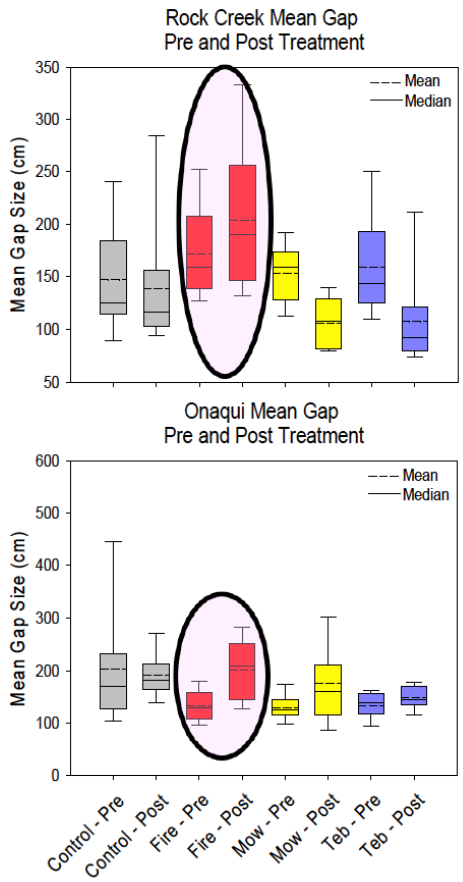
What are Inter-perennial plant gaps?

- Distance between bases of perennial plants at the soil surface

Why should we care?

- Portion of soil that is at the greatest risk to erosion, disturbance, and invasion

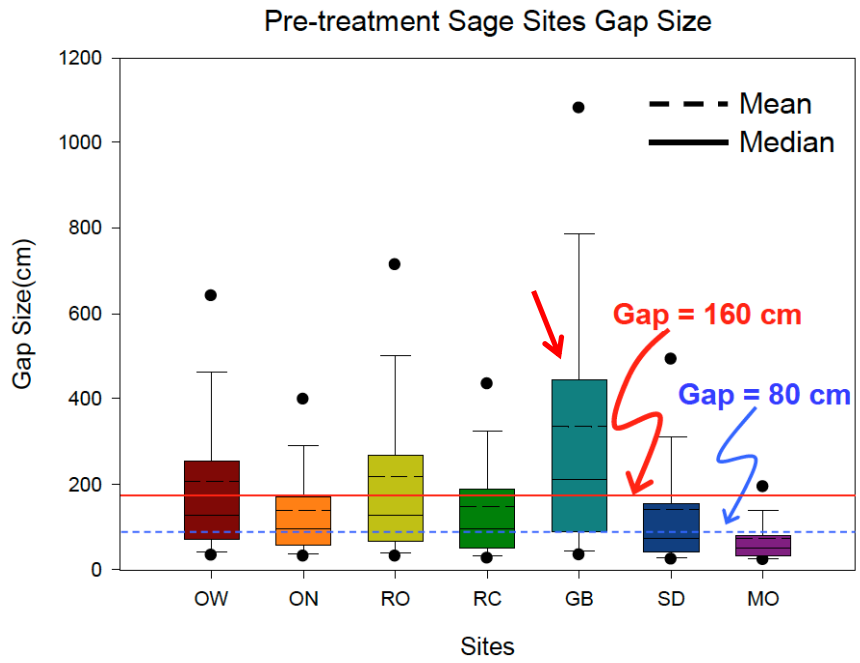
Example of changing gap sizes with treatment (from Pyke, ESA 2009)



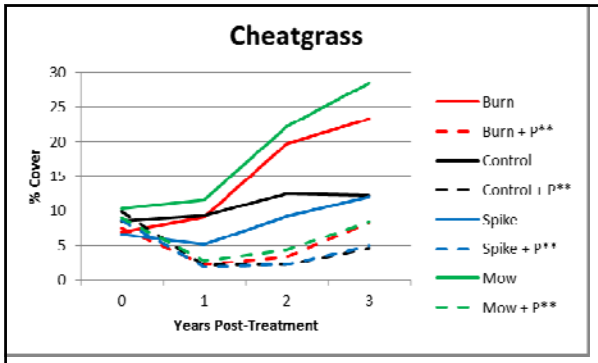
- At Rock Creek and Onaqui, mean gap size increased after the Burn
- Increases threat of erosion and annual exotic invasion

160 cm-gap size corresponds with ~30% perennial grass cover—which shows potential for cheatgrass dominance or co-dominance

(From Pyke, ESA 2009)

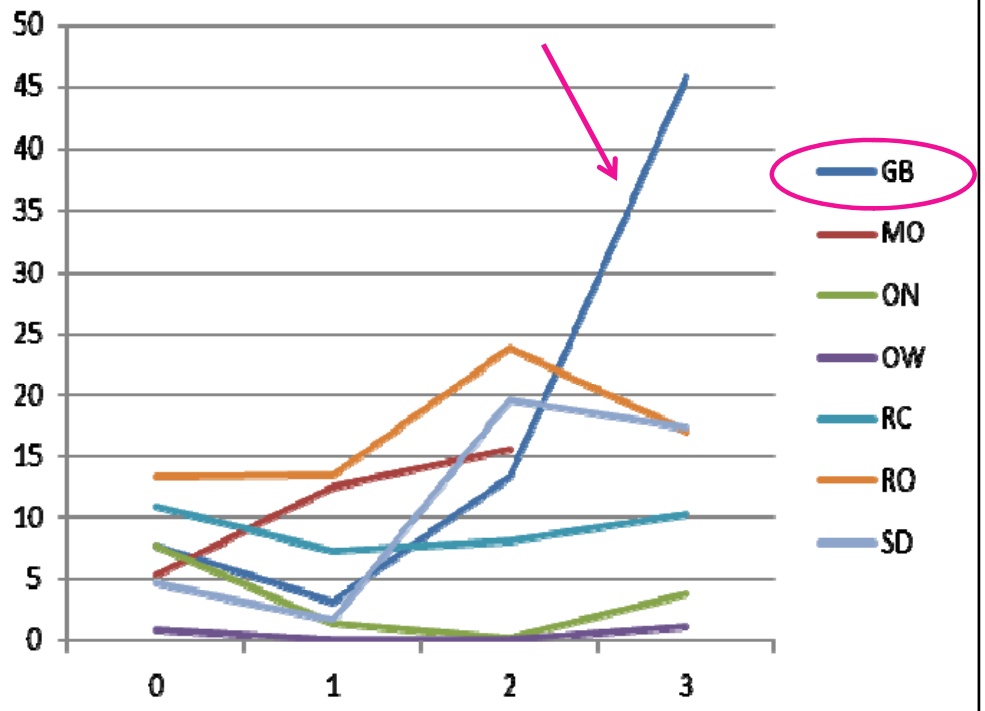


Gray Butte has the largest mean gap size



Burn plot,
cheatgrass cover by site

- Which can explain the large increase in cheatgrass at Gray Butte

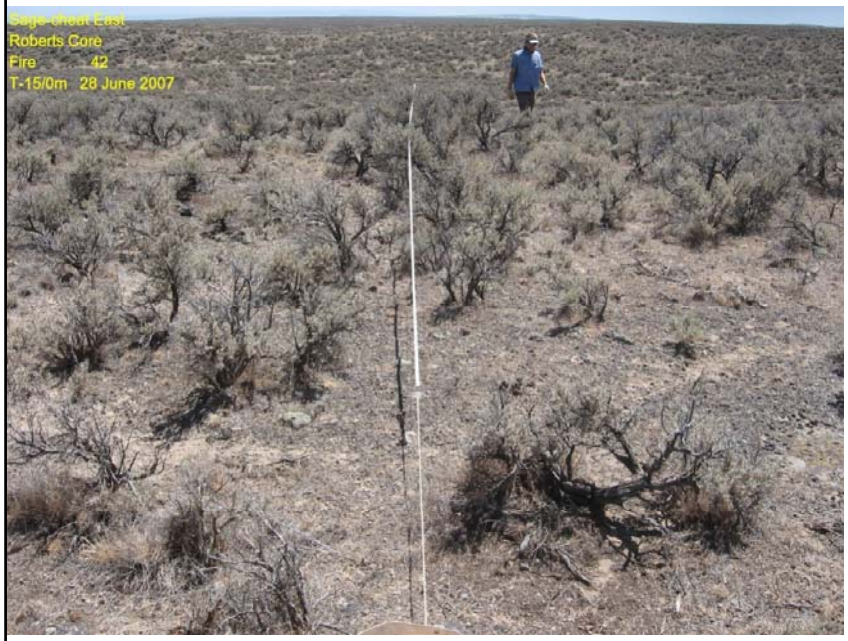


Gap Summary

- Fire can kill shrubs & grasses & increase basal gaps
- Plateau can temporarily decrease perennial plant cover and potentially increase basal gaps
- Inter-perennial plant gaps strongly related to cheatgrass dominance
- Management might consider maintaining smallest gaps possible
- Monitoring gaps between perennials may provide a fast early warning indicator of invasion potential.

Roberts Photo Sequence

No plateau



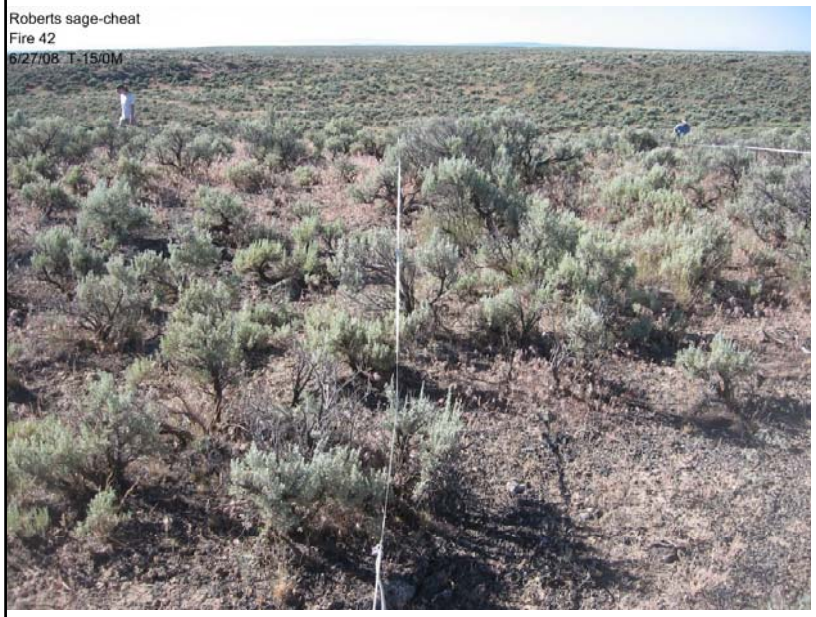
Plateau

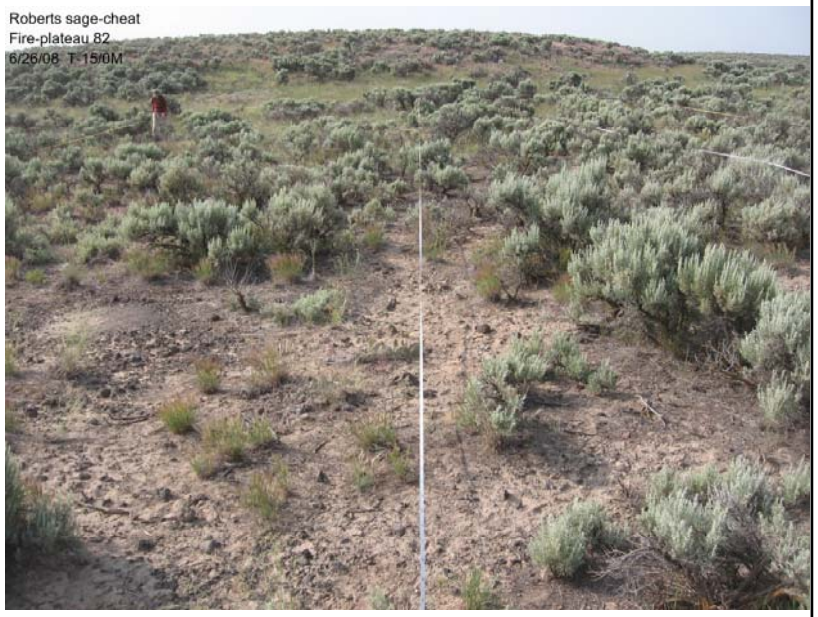
2007, pre-treatment

"Burn" plots

No plateau

Plateau



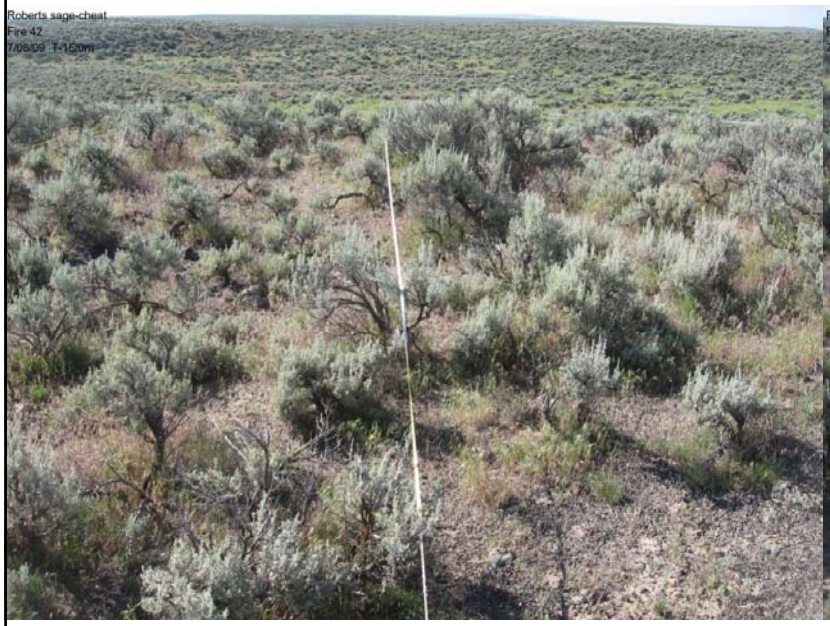


2008

"Burn" plots

No plateau

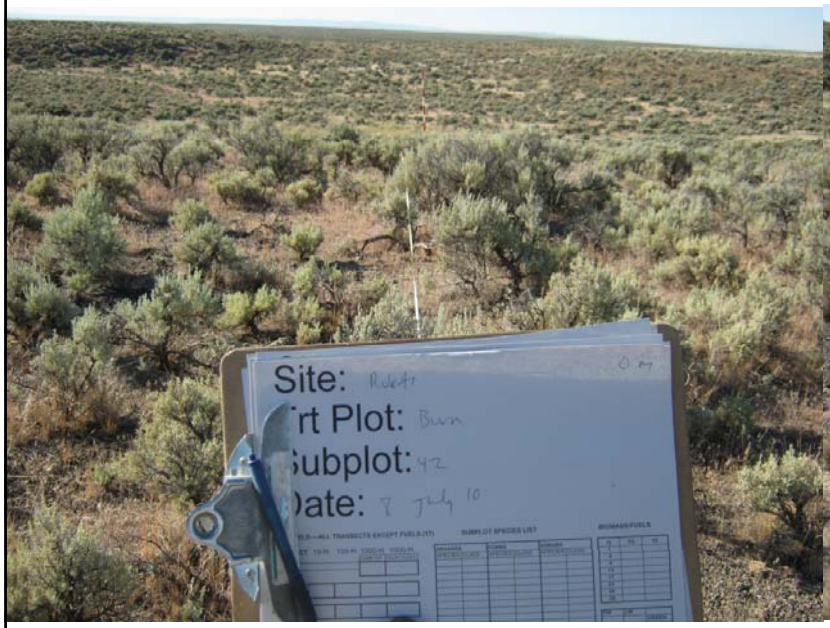
Plateau



2009

"Burn" plots

No plateau



Plateau

2010

"Burn" plots

No plateau

Plateau

2011

"Burn" plots

Conclusions

- Treatments result in increasing perennial grass cover after 2+ years, but recruitment is slow
- Sagebrush is regrowing and recruiting steadily at most sites
- Cheatgrass and annual forb cover increases following treatment without imazapic applied concurrently
- With imazapic, control is achieved for 2-3+ years
- Imazapic impacts native perennial grasses during the 1st year post-treatment; after this, these grasses recover to match unsprayed subplots

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- US Fish and Wildlife Service (especially Mid-Columbia River National Wildlife Refuges and Hart Mountain National Antelope Refuge)
- Nature Conservancy
- US Geological Survey
- National Interagency Fire Center

More information

- SageSTEP

  http://www.sagestep.org/

- Great Basin Science Delivery Project

  http://greatbasin.wr.usgs.gov/gbrmp/ScienceDelivery.aspx