Restoring shrub and aspen communities using prescribed fire on the Zumwalt Prairie Preserve

Pre-treatment conditions on Saddle Butte (2012)

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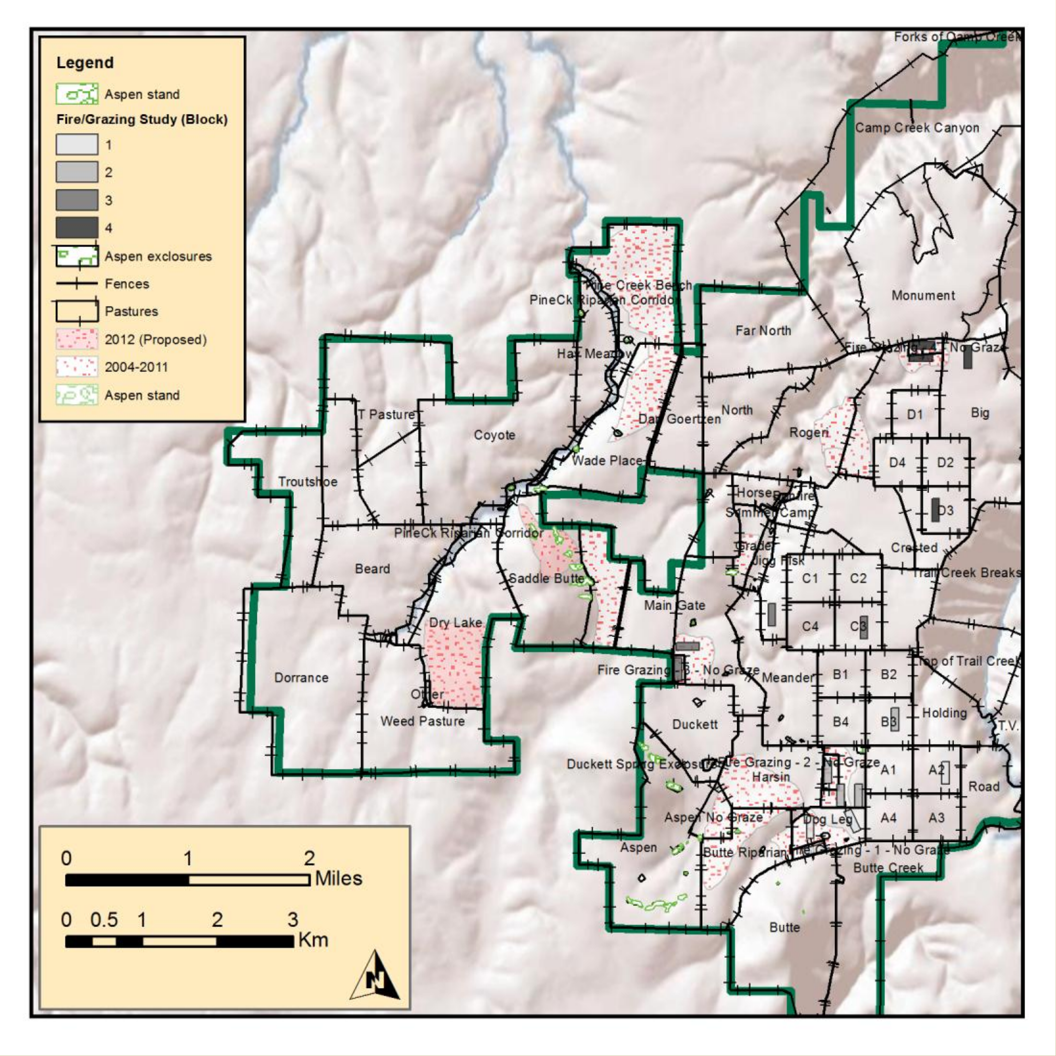
Background

Prescribed burning is done on The Nature Conservancy's the Zumwalt Prairie Preserve (ZPP) to emulate natural fire which occurred on this landscape for thousands of years prior to Euro-American settlement of the region in the late 19th century and the ecological effects they engender.

The first prescribed burn on the ZPP occurred in 2005 and was done for the purpose of removing standing dead foliage and litter to increase the effectiveness of herbicides in controlling noxious weeds (Figure 1). Since then 9 additional prescribed burns have been performed.



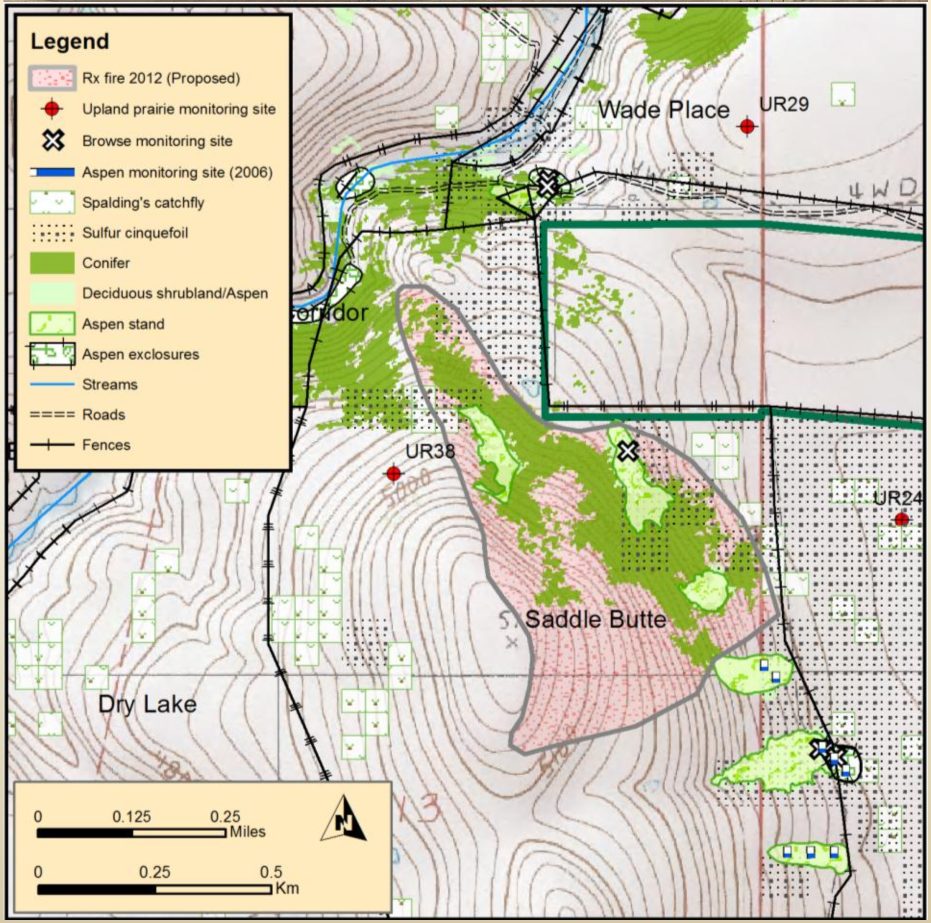
The Saddle Butte Burn

The Saddle Butte Burn (SB) area (37 ha) has deep silt loam soils and is dominated by Ponderosa Pine (*Pinus ponderosa*) with scattered individuals of Douglas fir (*Pseudotsuga menziesii*) and grand fir (*Abies grandis*). It also contains four aspen stands and deciduous shrubs such as black hawthorne (*Crataegus douglasii*), saskatoon serviceberry (*Amelanchier alnifolia*), chokecherry (*Prunus virginiana*), ninebark (*Physocarpus malvaceous*), Douglas' spirea (*Spirea douglasii*), currant (*Ribes spp.*), rose (*Rosa spp.*), and Oregon grape (*Mahonia repens*). The noxious weed sulfur cinquefoil occurs (very sparsely) on the lower slopes of the proposed burn area.

The goal of this prescribed fire is to reduce the abundance of conifers thereby stimulating the growth of aspen and shrubs. This in turn is hoped to improve habitat conditions of Columbia sharp-tailed grouse (*Tympanuchus phasianellus columbianus*) and other species which depend on aspen and deciduous shrub communities some or all of their life cycles.

In addition to prescribed fire, other interventions may be used to achieve the desired outcomes, including: thinning of conifers, fencing to exclude ungulates from certain areas, and seeding with native grass species.


view of proposed burn area from north



A few words about conifer encroachment

The Zumwalt prairie is a fire-adapted ecosystem and natural, lightening-caused fires probably occurred every 5-15 years since the end of the last ice age. Indigenous people may have intentionally set fires thereby increasing the frequency of fire. In the past 100 yr, livestock grazing and fire-suppression has reduced fire frequency which has likely affected plant communities and other ecosystem characteristics. Fires reduce the abundance of conifer species and create stands consisting of sparse, old trees that can survive fire while saplings and younger trees are kept in low numbers. Frequent fire also promotes the growth of aspen and many fire-tolerant deciduous shrub species.

1991

Photo: Findley Family

2008

Photo: R. McEwan

The photos on the left show the northeast side of the Harsin Butte on the Zumwalt Prairie Preserve. As you can see, the amount of conifer forest has increased dramatically in the 27 years from the time the first photo was taken in 1991.

While timber harvest has been suggested as one possible reason for the low number of trees seen on the buttes in prior decades, the lack of cut stumps suggests this is probably not the case.

Objectives, Indicators and Monitoring

Objective	***Indicator***	***Monitoring***	***Comments***
Reduce the cover of Ponderosa pine and Doug fir within the burn area by 15% within 1 yr; overall goal is to reduce conifer cover by 75% in 15 yr.	Foliar cover of all conifer species	Canopy cover of conifers using remote-sensed imagery (e.g., NAIP, LandSat, Ikonos) prior to and subsequent to burn.	The few large, presumably old, ponderosa pines in the burn unit would be protected from fire; more than one Rx burn may be necessary; reduction in conifer cover could also be addressed w/ other treatments (thinning); Crystal Kolden (Dept. of Geography, Univ. of Idaho) will lead this monitoring with students (*pro bono*). Imagery cost estimated @ $800-1000 to be provided by TNC.
Increase deciduous shrub cover by 50% within 5 yr of burn.	Foliar cover of deciduous shrubs	Measure cover of a key deciduous shrub species using the “Line-intercept” method (Elzinga et al. 1998). Data collected from 27, randomly located, permanently marked, survey sites, each consisting of a single 50 m transect.	Data collected to species level; for low growing shrubs such as snowberry, and spirea only stems and leaves > 0.5 m in height was measured
Increase the number of aspen suckers (< 2m) by 100% within 2 yr; Increase the number of aspen above 2m in height by 1000% within 10 yr.	Density of aspen suckers and density of aspen stems above 2m in height	Measure density of live aspen stems by height class (0-2 m; > 2m) using belt transects (Herrick et al. 2005). Data were be collected from approximately 7 randomly located, permanently marked survey sites each consisting of a single 50 m x 4 m belt transect.	The most westerly of the three aspen stands in the unit is virtually dead (no living stems observed in May of 2012); ungulate browse will be assessed after the burn. If browse is heavy, large elk-resistant exclosures will be constructed to protect areas having high potential for aspen and shrub growth.

Elzinga, C., D. Salzer, and J. Willoughby. 1998. Measuring and Monitoring Plant Populations. Technical Reference 1730-1, Bureau of Land Management.
Herrick, J., J. Van Zee, K. Havstad, L. Burkett, and W. Whitford. 2005. Monitoring Manual for Grassland, Shrubland and Savanna Ecosystems, Volume I: Quick Start. Tucson, Arizona: The University of Arizona Press.

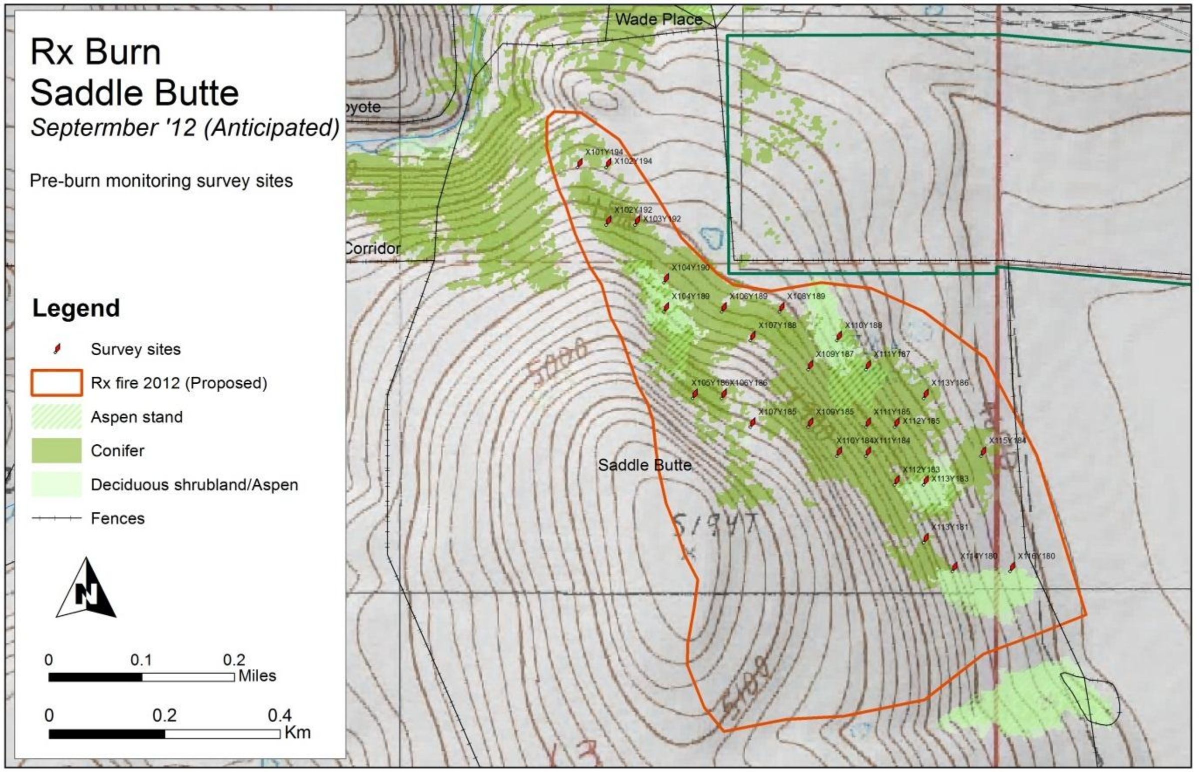
Pre-treatment data collection

Pre-treatment data were collected in the summer of 2012. TNC crews measured shrub cover and density of aspen stems at 27 randomly located survey sites within the proposed burn unit. 20 of these transects were in areas previously mapped as having coniferous forest cover whereas 7 were in areas mapped as having aspen and deciduous shrubs (TNC, unpublished data; see map below). A single photo-point was also taken at each site. Details on the methods used for collecting these data can be found in *Methods for Measuring Shrub Canopy Cover and Aspen Density* by L. Bailey and R.V. Taylor.

In addition to these data we also collected data on conifer density, species composition, and age. While these do not directly relate to the management or monitoring objectives for the proposed burn, they provide important information relating to the ecological history of the site and may help to guide future management of conifer, aspen, and shrub communities on the Zumwalt Prairie. Furthermore, the only opportunity to obtain these data is prior to burning. Conifer density (by species) and the diameter at breast height (i.e., 1.5 m) of each tree was measured within a 10 m radius plot at each of the 27 survey sites. A count of saplings (< 1.5 m in height) was also tallied.

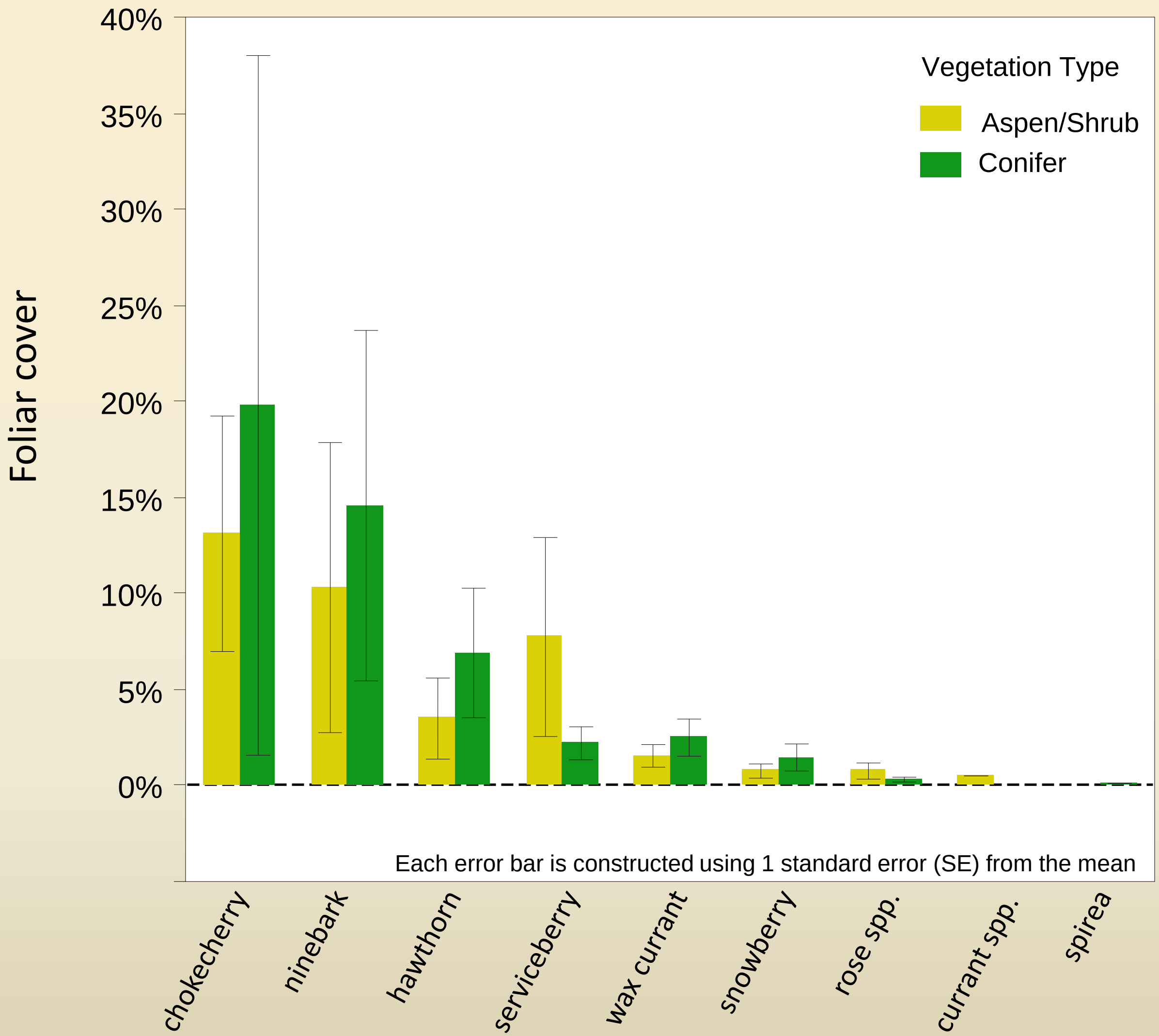
At one third of these sites (chosen randomly) we also measured tree age by taking increment core from each of the conifer stems within the plot at 1.5 m (i.e., “breast height”, counting the growth rings, and adjusting the measure based on the average age of 7). Finally, we estimated bare ground at each of the 27 sites. More details on this sampling can be found in *Methods for Measuring Conifer Density, Age, and Bare Ground* by L. Bailey and R.V. Taylor.

On 15 September Crystal Kolden and her Advanced GIS class collected field data on conifer cover and crown bulk density at each of the 27 survey sites. These data will be used in calibrating the remote sensing data. Data on conifer cover will be described in a separate report.



Results

Aspen and Shrub Cover



Foliar cover of deciduous shrub species at 20 conifer sites and 7 aspen/shrub sites as determined by line-intercept on 50 m transects.

Eleven species of deciduous shrubs were encountered at the 27 survey sites (see figure to left). In addition to wax currant, one other species of currant was encountered that could not be identified. Though present at some of the sites, aspen and Oregon grape cover was never detected. For the former, cover was only measured if it was less than 2m in height. For the latter, plants were never greater than 0.5 m in height and thus was not measured (see detailed methods).

The most abundant shrubs encountered were serviceberry (18% ± 13% SE), ninebark (13% ± 6%), hawthorn (5% ± 2%), and serviceberry (4% ± 2%).

Sites in the “aspen/shrub” areas (see methods) generally had more shrub cover than those in areas mapped as “conifer”.

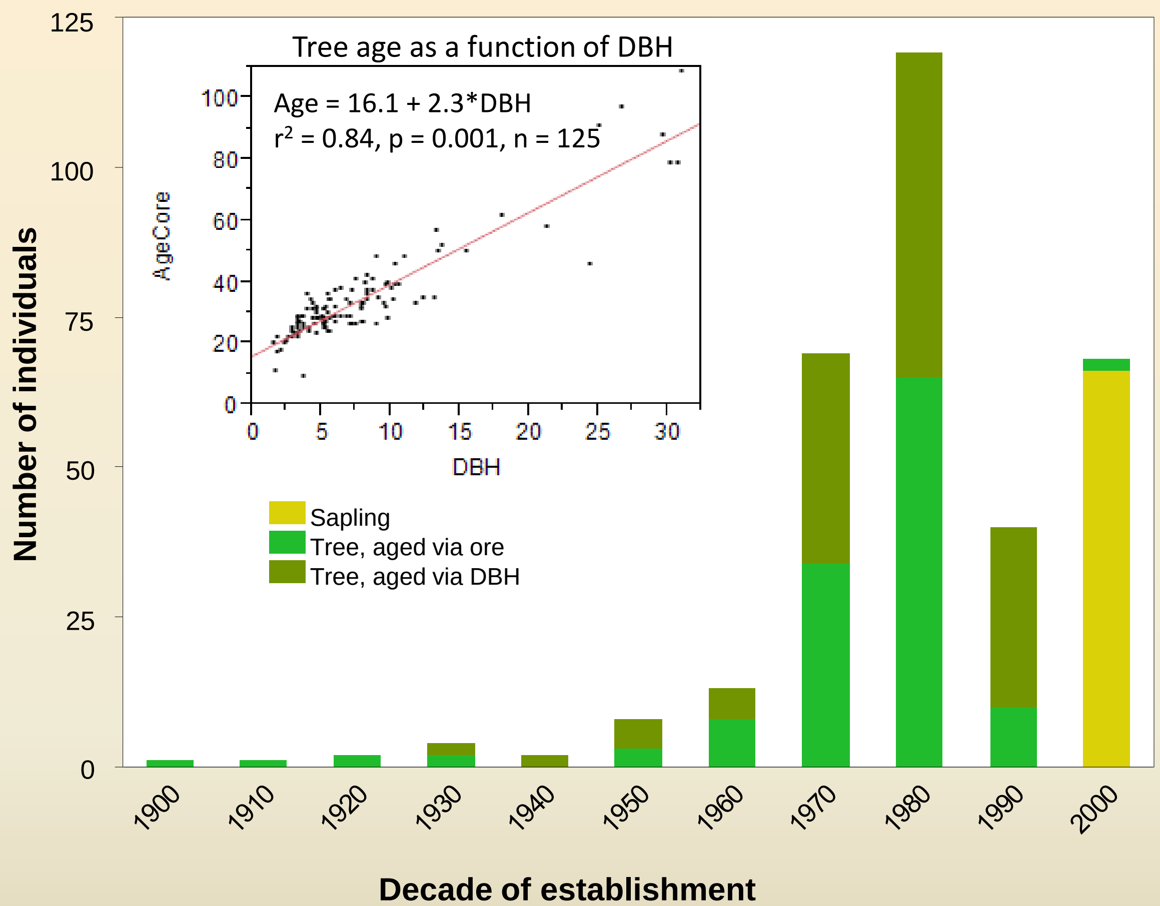
Conifer density and age

We found an average of 0.01 trees / m^2 (± 0.002 SE) and 0.008 (± 0.002) saplings / m^2. Ponderosa pine made up 99% of the trees and 100% of the saplings encountered. In addition we counted 3 Doug Fir and 1 Grand Fir.

There was a strong correlation (84%) between tree girth and tree age thus allowing us to estimate the ages all 298 ponderosa pines in the plots.

The vast majority of conifers on Saddle Butte were young (< 40 yr). Eighty-eight of the trees established in 1970 or later. The oldest tree observed was 109 yr in age, however, the ages of the oldest trees may have been underestimated as it was sometimes difficult to reach the center of very large trees with the increment borer.

These data, along with the paucity of stumps from past timber harvest (no stumps were observed at any of the survey sites) suggest that tree recruitment increased dramatically after the 1960s and that Saddle Butte had minimal conifer cover in the past.



Conifer age based Increment cores from 125 ponderosa pine (*Pinus ponderosa*), 2 grand fir (*Abies grandis*), and 1 Douglas fir (*Pseudotsuga menziesii*). Ages of an additional 133 ponderosa pine trees, for which only diameter at breast height (DBH) was measured, were estimated using linear regression (see inset). Ages of 66 ponderosa pine saplings (< 1.5 m in height) were estimated based on measured ages of 10 saplings.

Photopoints – Conifer Sites

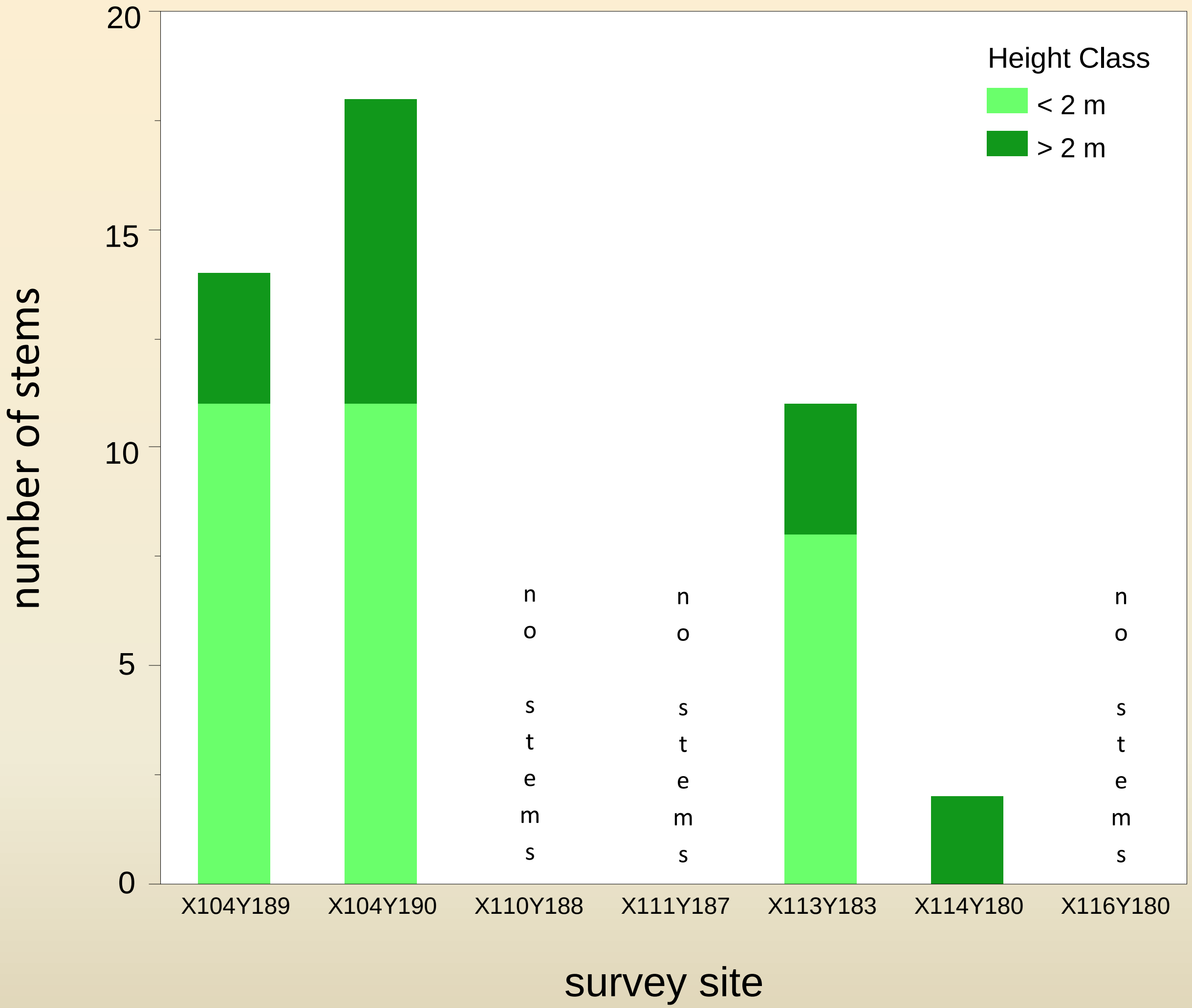
X102 Y192

Ponderosa pine forest with low abundance of saplings and understory shrubs

X111 Y185

Ponderosa pine forest with high abundance of saplings and understory shrubs (principally chokecherry, ,hawthorn, and ninebark)

Aspen Density



Aspen stems encountered on 50 m x 40 m belt transect at the 7 survey sites mapped as "aspen/shrub" . Stems < 2m in height were counted separately from taller than 2m. No aspen were found at any of the 20 "conifer" sites.

A total of 45 live aspen stems were encountered within the belt transects of the study sites. Only sites within stands previously mapped as having aspen had aspen present; no aspen were found at sites in areas mapped as "conifer". Within the aspen stands, aspen was present in only 4 of the 7 survey sites (see figure to left). Overall density of aspen stems was 0.16 stems / m^2 (±0.006 SE) across the 7 sites. Young suckers and other short stems (< 2 m) occurred at nearly double the density (0.02 m^2 ± 0.01 SE) than stems ≥ 2 m in height (0.01 / m^2 ± 0.005 SE).

Photopoints – Aspen/Shrub Sites

X104 Y190

Aspen stand with relatively high number of short and tall stems

X110 Y188

Aspen stand with no live stems

Summary and Future Plans

- ✓ The Saddle Butte prescribed burn seeks to restore the natural fire cycle and improve the condition of aspen and shrub communities

- ✓ Pre-treatment data collection for the Saddle Butte prescribed burn was completed in the summer of 2012; data indicate that significant conifer encroachment has occurred in the past 50 yr and aspen stands are in poor condition.

- ✓ Providing the prescribed burns occur, as planned, in the fall of 2012, post treatment monitoring of aspen stands will begin 2014.

Acknowledgements

This work would not have been possible without the able assistance of Lydia Bailey, Christina de Villier, and Mindy Trask.

THANK YOU!

Jeff Fields, Justin Jones, and Steve Buttrick provided thoughtful feedback on both burn and monitoring objectives for which I am grateful.

Appendix 1 – Live fuel moisture

Live fuel moisture was estimated on 15 Sep 12. Two ponderosa pine “cookies” (segments of live branches approximately 3-5 cm in diameter) and approximately 50 needles were collected from 5 well-distributed sites on Saddle Butte. Samples were stored in plastic bags until 16 Sep at which time they were transferred to paper sacks and dried in a household oven at very low temperatures (40-45° C) from 16 – 26 Sep. Bags were weighed occasionally and were considered “dry” when weights stabilized. Mean moisture content was 35% for cookies and 54% for needles.