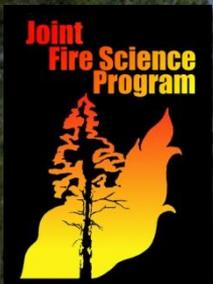


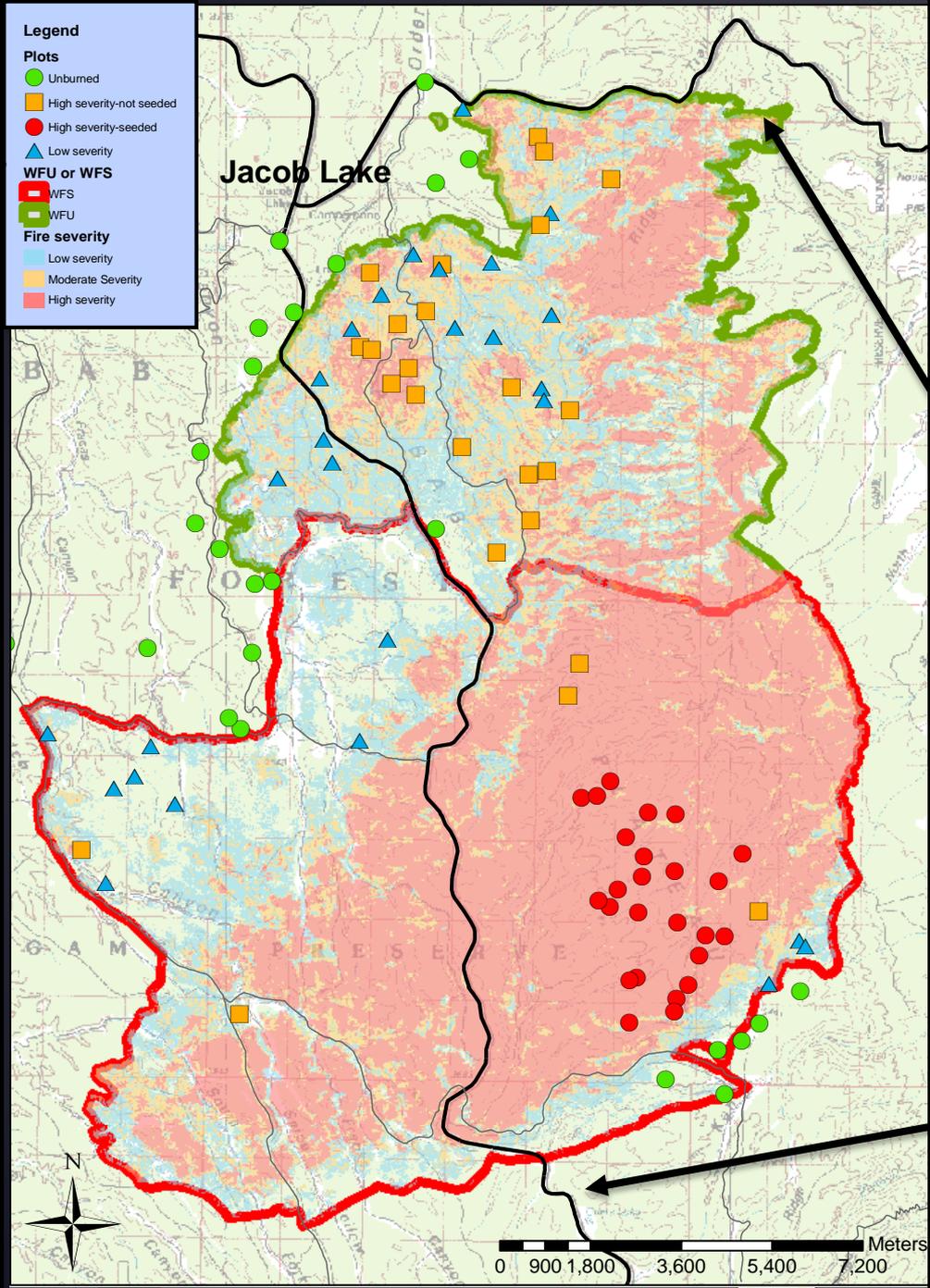
Changes in Vegetation and Fuels on the Warm Fire

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GRAND CANYON TRUST



Warm Fire

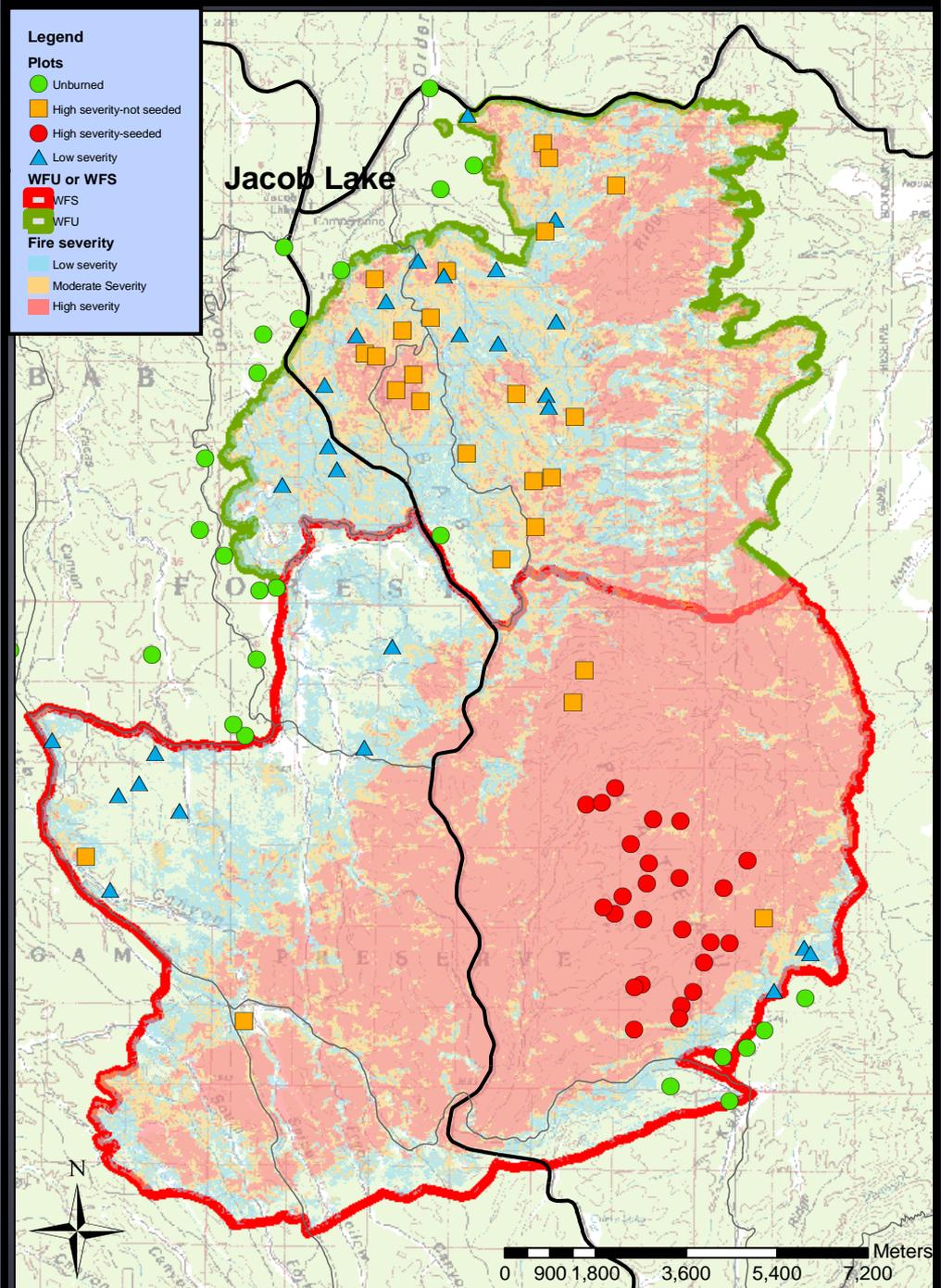
- June 8, 2006, Wildland Fire Use Fire
- Conversion to Wildland Fire
- Burned a total of 24,000 hectares



Plot Selection

Stratification of plots by:

1. Vegetation type
2. Soils
3. Fire severity
4. Elevation
5. Proximity to burn border for controls
6. 25 per treatment



Management

What does the Kaibab National Forest want to know?

- WFU vs. Wildfire
- Planting project post-fire
- BAER treatments
 - Seeding of *Lolium multiflorum*

What are the results?



Lolium multiflorum

Annual-perennial-
hybirdizes

Controversial-
effectiveness at
erosion control

Competitive
advantages over
native vegetation

Decreases native
cover, richness and
diversity

Correlation
between ryegrass
and lower conifer
regeneration



Sampling in 2007 & 2008:

2005: 16 GCT (4 seeded, 3 high not seeded, 4 low)

2007: 49 total

- 14 plots high severity
- 13 plots moderate severity
- 12 plots low severity
- 10 control plots

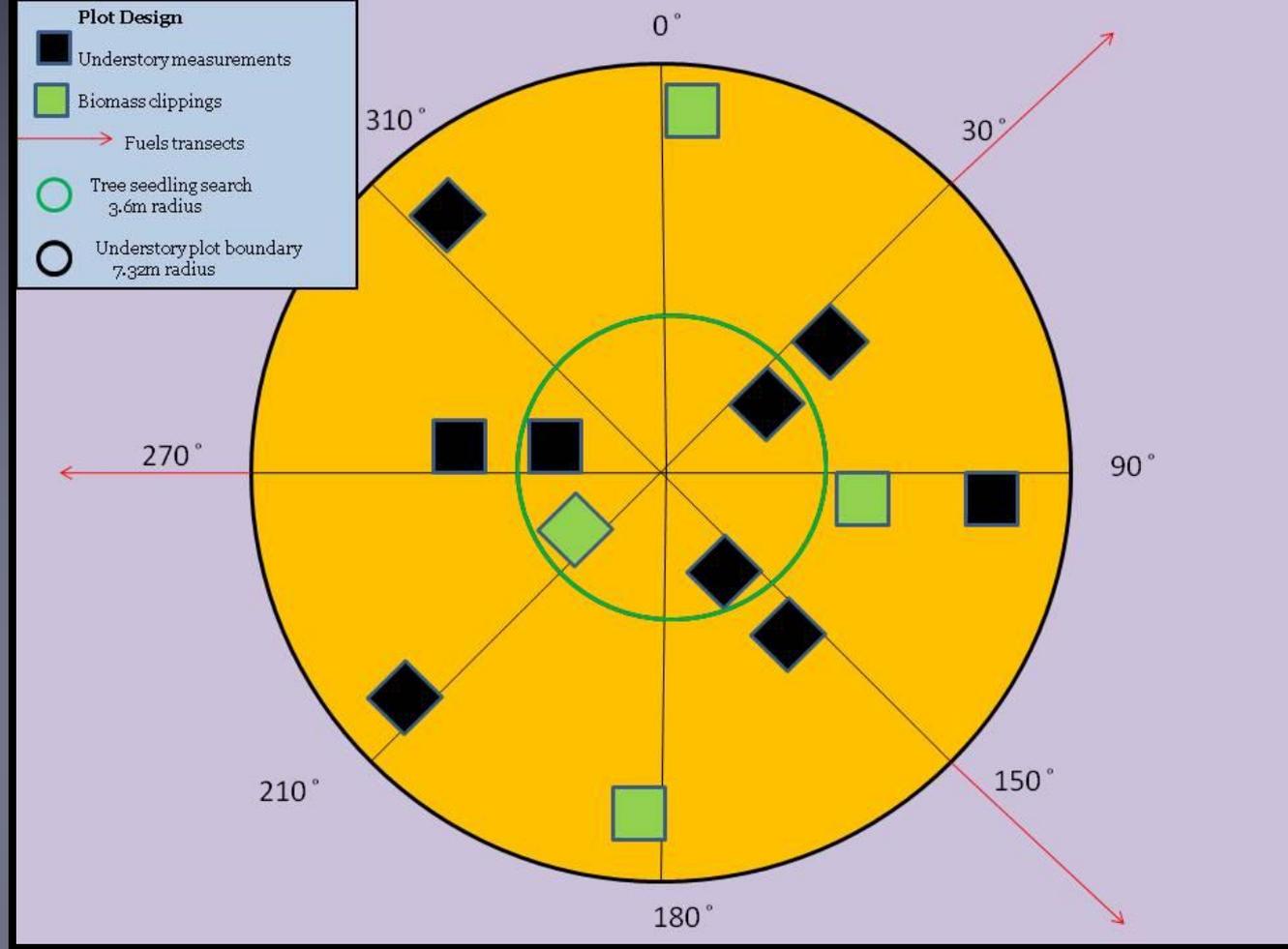
2008: 100 total plots

- 25 high fire severity seeded
- 25 high severity not seeded
- 25 low severity not seeded
- 25 controls



Understory data

- % cover per species
- % cover forbs
- % cover total vegetation
- % cover grasses
- % cover substrates (rock, soil, litter, duff, lichen, moss)
- Average height per species



• Shrub count

Fuels-3transects

• Species search

• Canopy cover measurements

• Conifer seedling search

Biomass : 4 1x.25m
Species
Density



Overstory sampling

2007: Live ponderosa only for regression analysis

- Tree height
- Bole scorch height and severity
- DBH to the nearest cm
- Height to live crown
 - pre and post fire
- Percent scorch (black/gone) and torch (brown) of the pre-fire crown

Overstory measurements on all plots for all trees for stand characteristics/analysis

tree height, DBH, species and live or dead

2008:

- Recorded Live/Dead for all tagged ponderosa pine: 410
- Continued recording stand characteristics for plots
 - Density/species, tree height, crown base height, DBH



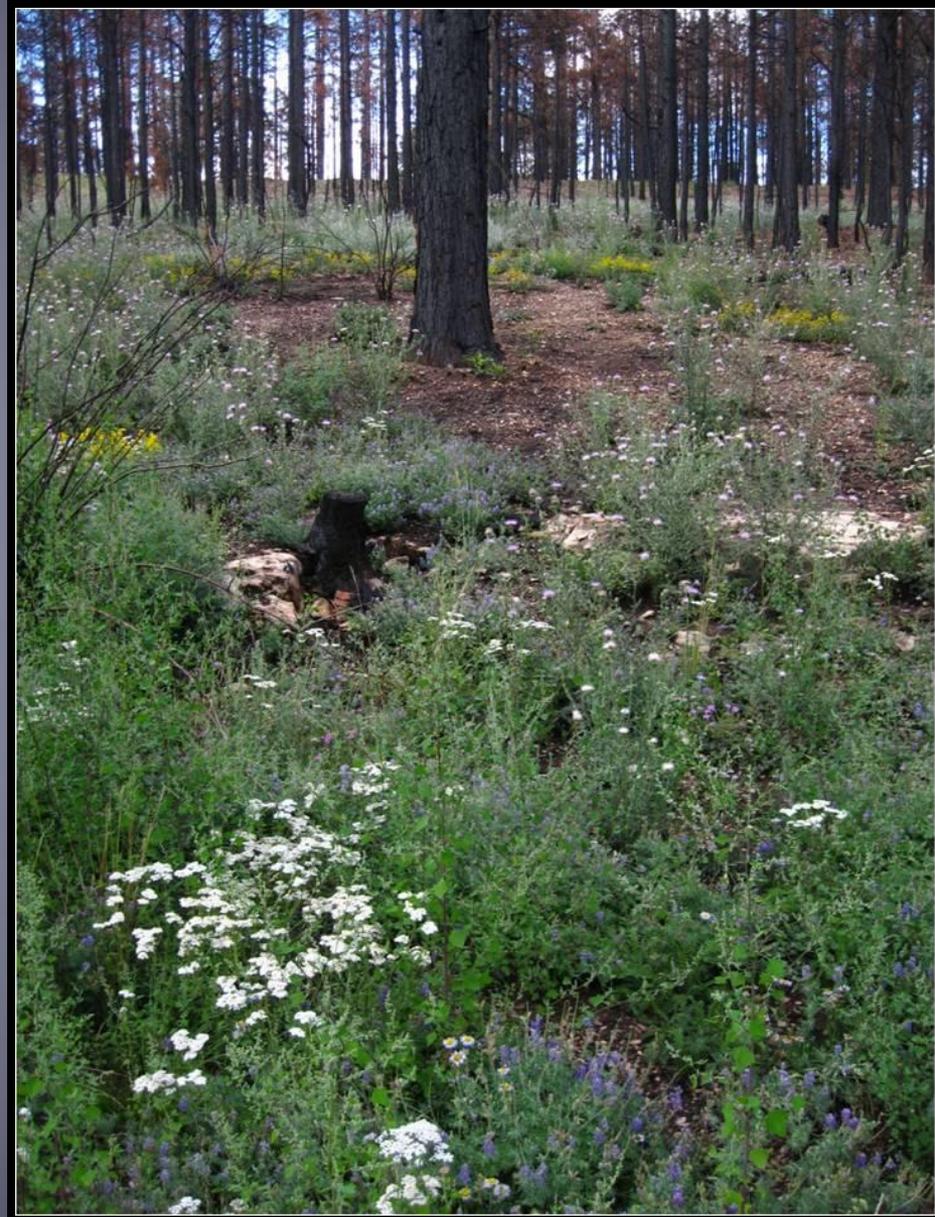
Research Questions

- Determine the effects of treatments (seeding and burn intensity) on plant community, native species cover, diversity and richness
- Assess the influence of seeding on conifer regeneration and survivorship
- Determine the effects of treatments (seeding and burn intensity) on exotic plant cover and presence.

Research Questions cont.

- Ponderosa pine mortality
 - McHugh and Kolb (2003)
 - Predictors of ponderosa pine mortality-post fire
- Fuels
 - What differences do we see in 1, 10, 100 and 1,000 hour fuels in different severities?
 - How does litter and duff depth vary by fire severity?





High burn severity Seeded vs. Not seeded

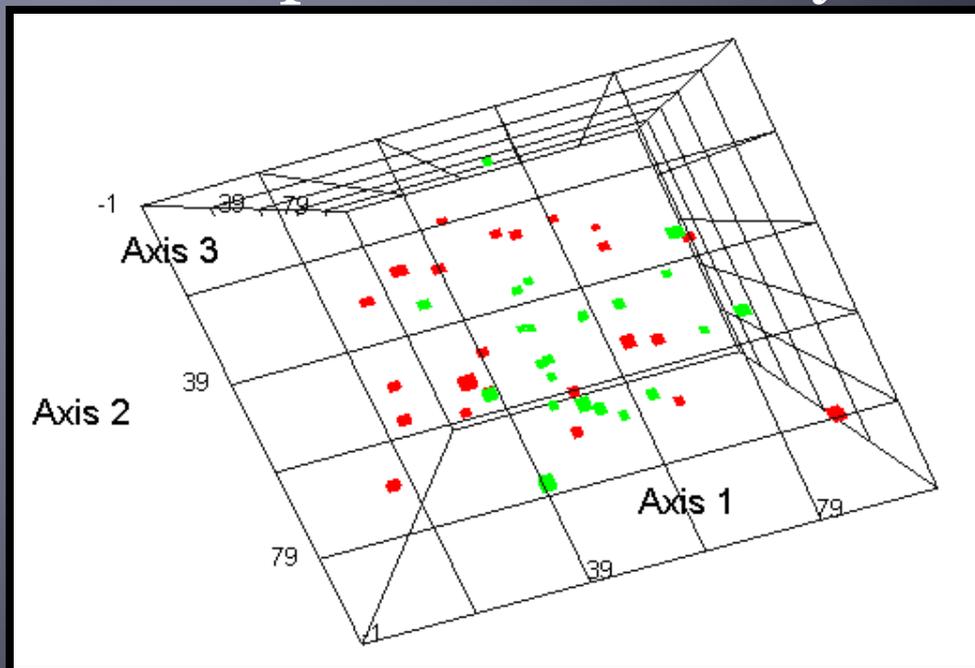
Plant Community Analysis PC-ORD

PerMANOVA: distance based MANOVA

Significant difference in plant community
composition

$p = .016$

68% variation
explained by
seeding



Indicator Species Analysis

Table 1.

Indicator species analysis results for significant indicators only (p<.05)

Seeded	Non-seeded
<i>Lolium multiflorum</i> - Italian ryegrass	<i>Pinus ponderosa</i> - Ponderosa pin
<i>Astragalus subcinereus</i> - Sliver's milkvetch	<i>Populus tremuloides</i> - Aspen
<i>Linum puberulum</i> - Plain's flax	<i>Verbascum thapsus</i> - Woolly mullein
<i>Lotus wrightii</i> - Wright's deervetch	<i>Pseudognaphalium macounii</i> - Cotton cudweed
	<i>Antennaria parvifolia</i> - Small leaf pussytoes
	<i>Androsace septentrionalis</i> - Rock jasmine
	<i>Muhlenbergia montana</i> - Mountain Muhly

*** Ponderosa pine and aspen reported as strong indicators for non seeded areas.



Seeding effects on conifer regeneration and survivorship

- ANOVA

Not statistically significant, BUT so close

$p = .053$

*Run with community data ~ $p = .002$



Exotic vs. Native cover

- Is *Lolium* keeping exotic cover low?
- No significant difference between exotic ($p=.1743$) and native ($p=.4425$) cover between seeded vs. not seeded
- Without ryegrass?



Analysis on *Bromus spp.*

- Is there a difference in presence of *Bromus spp.* between seeded and not seeded????

Yes! But not what was expected.

Results:

Bromus spp. was present in twice as many non-seeded plots as seeded.

Early conclusions

1. Observed a significant difference in community composition
2. Competition from the *Lolium multiflorum* may be effecting tree seedling recruitment
3. Seeding has various effects on the presence or cover of exotics
4. The *Lolium multiflorum* is effecting the plant community composition now, but what about next year?



Future Analysis

- Continue with vegetation data
 - analysis by severity
 - multiple seasons
 - functional groups
 - Legumes, C3 and C4 grasses, life traits
 - annuals vs. perennials
- Regression Analysis of ponderosa pine mortality
- Fuels Analysis-Matt Flying





Potential thesis chapters

- Chapter 1: Introduction
- Chapter 2: Effects on plant community composition after a post-fire reseeding.
- Chapter 3: (maybe combined with 2) Understory vegetation community response to high and low severity fires.
- Chapter 4: Conclusions and Management Implications



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