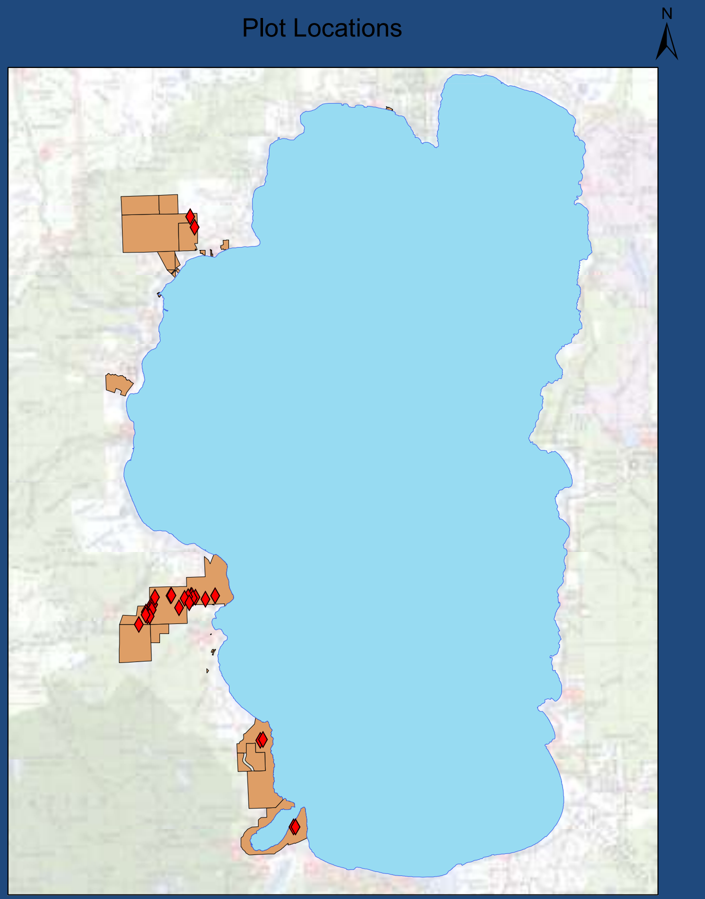
Understory Change in Prescribe Burned and Passively Managed Forests over 20 Years

Svetlana Yegorova
CA State Parks, Sierra District

Background

- Changing view of fire
- Goal: fuels reduction, ecological benefits of fire
- A pulse of burning in 1990's, and an establishment of permanent monitoring plots
- NPS Fire Monitoring Handbook



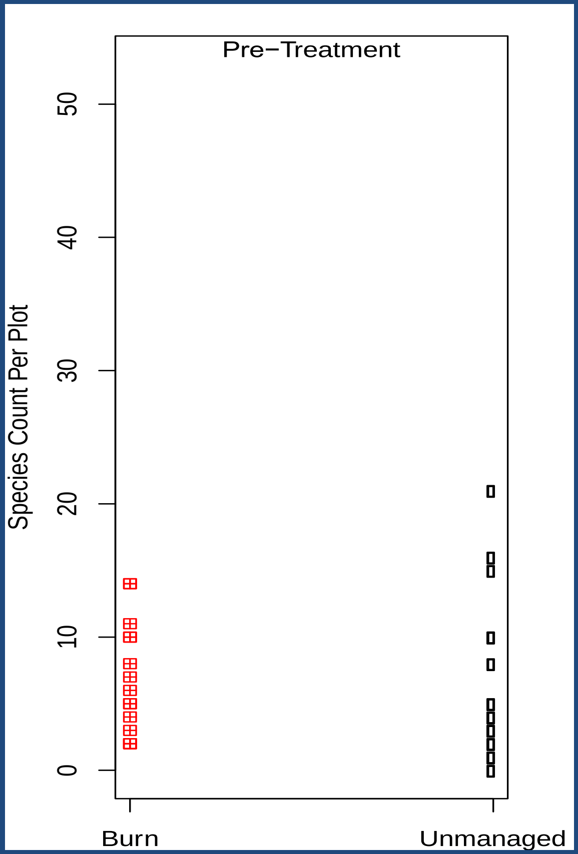
How does the understory vegetation layer respond to prescribed burning?

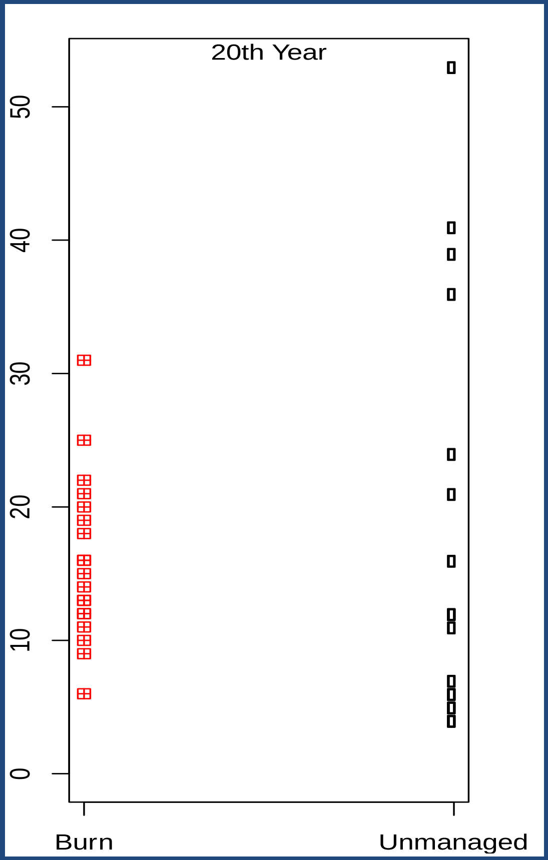
- Does burning affect species richness positively?
- Do burned areas contribute a different suite of species compared to the unmanaged areas?
- Does burning encourage invasive species introduction and spread?

Results: Species Richness

Pre-treatment and 20th year.

Note pre-treatment and 20th year data collected at different scales



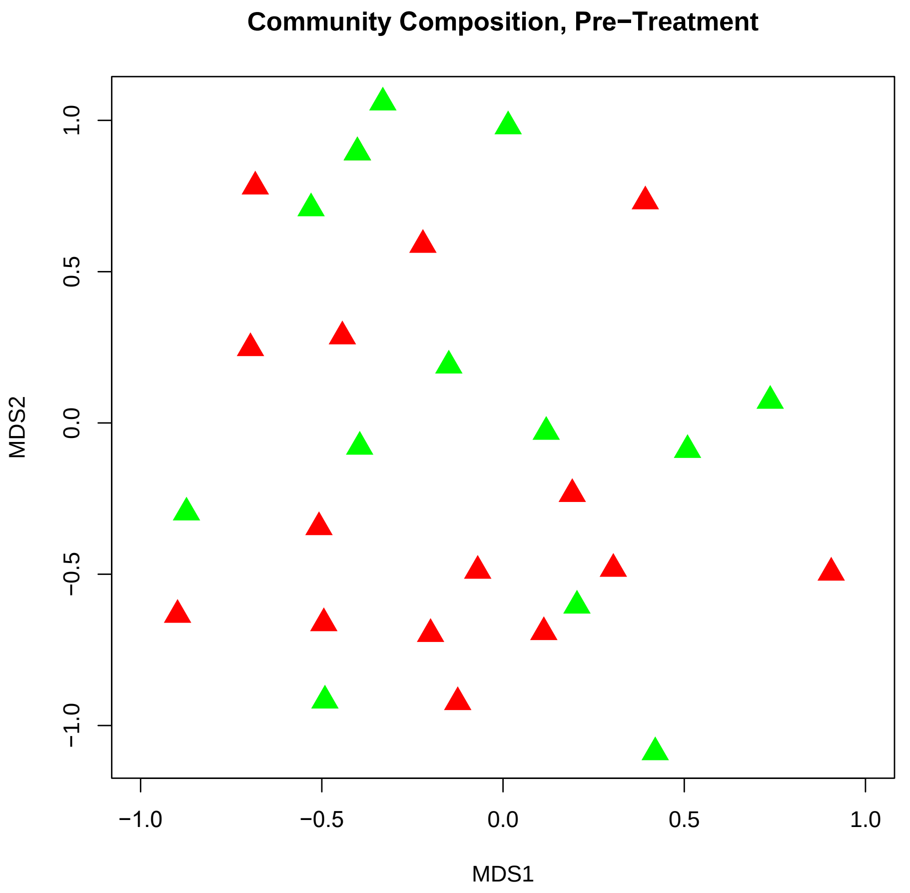


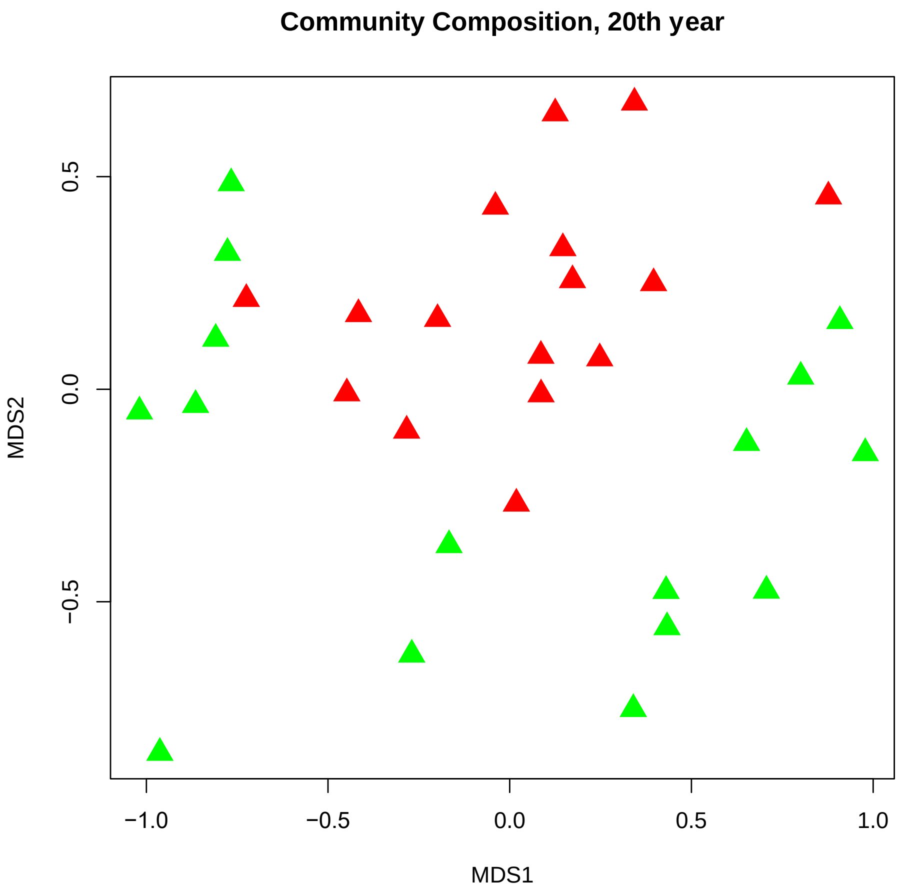
Wicoxon rank test:

Pre-treatment richness ($p = 0.54$)

20th year richness ($p = 0.32$)

Species Community Composition





Indicator Species, 20 years after treatment

- Arctostaphylos patula

© 2009 Kier Morse

- Ceanothus cordulatus

© 2009 Barry Breckling

- Pinus jeffryi seedlings

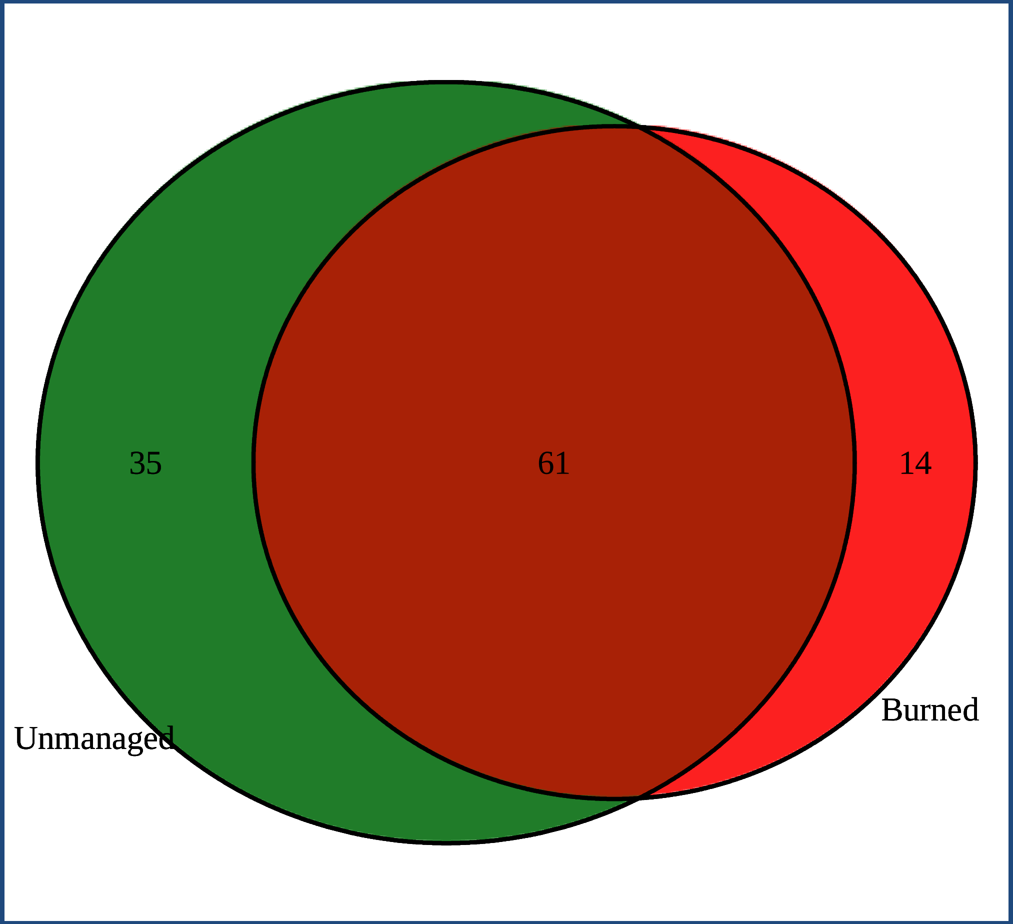
© 2004 Charles Webber

- Goodyera oblongifolia

© 2008 Steve Matson

Do both burned and unmanaged areas contribute to overall species richness?

20 th Year



What about invasive plants?

- no invasive species identified in pre- or 20th year datasets
- Plumas-Eureka SP (not represented in the dataset) – Circium vulgare, Verbascum thapsus

(Conditional) Management Implications

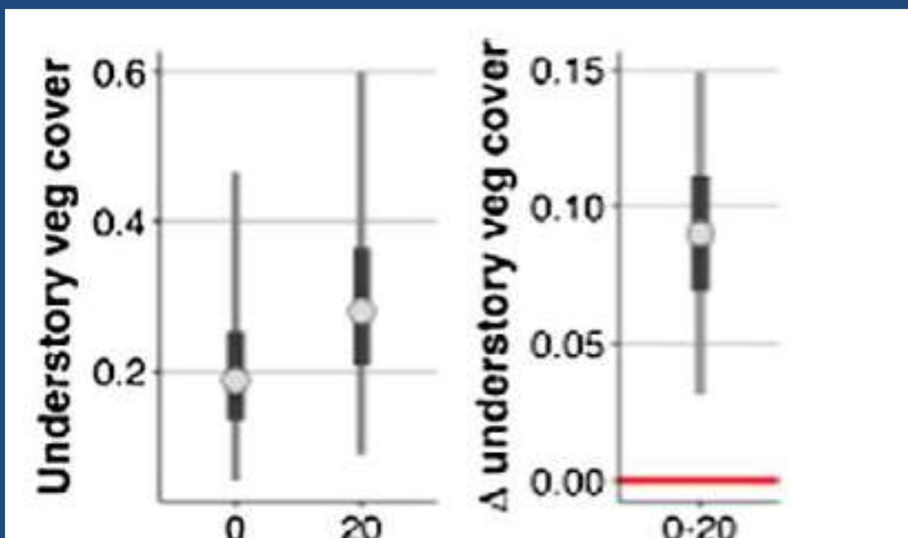
- Rx burning did not harm (and may have benefitted) species richnes
- Rx burning set understory communities on a distinct development path compared to unmanaged areas
- Both passive management and prescribed burning contribute to maintain the full suite of understory species

Questions?

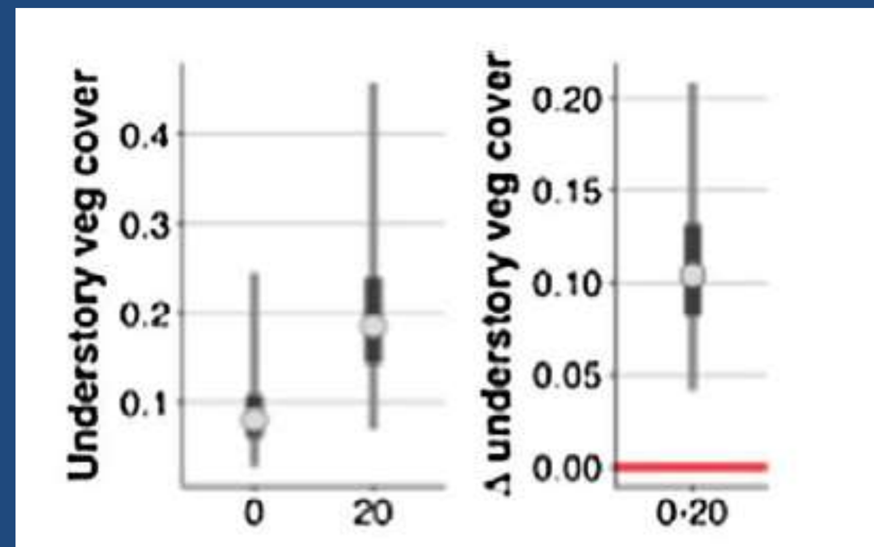
Svetlana Yegorova
svetlana.yegorova@parks.ca.gov

Understory Cover

Unmanaged plots



Burned Plots



Contents lists available at ScienceDirect

Forest Ecology and Management

journal homepage: www.elsevier.com/locate/foreco

Prescribed fire and natural recovery produce similar long-term patterns of change in forest structure in the Lake Tahoe basin, California

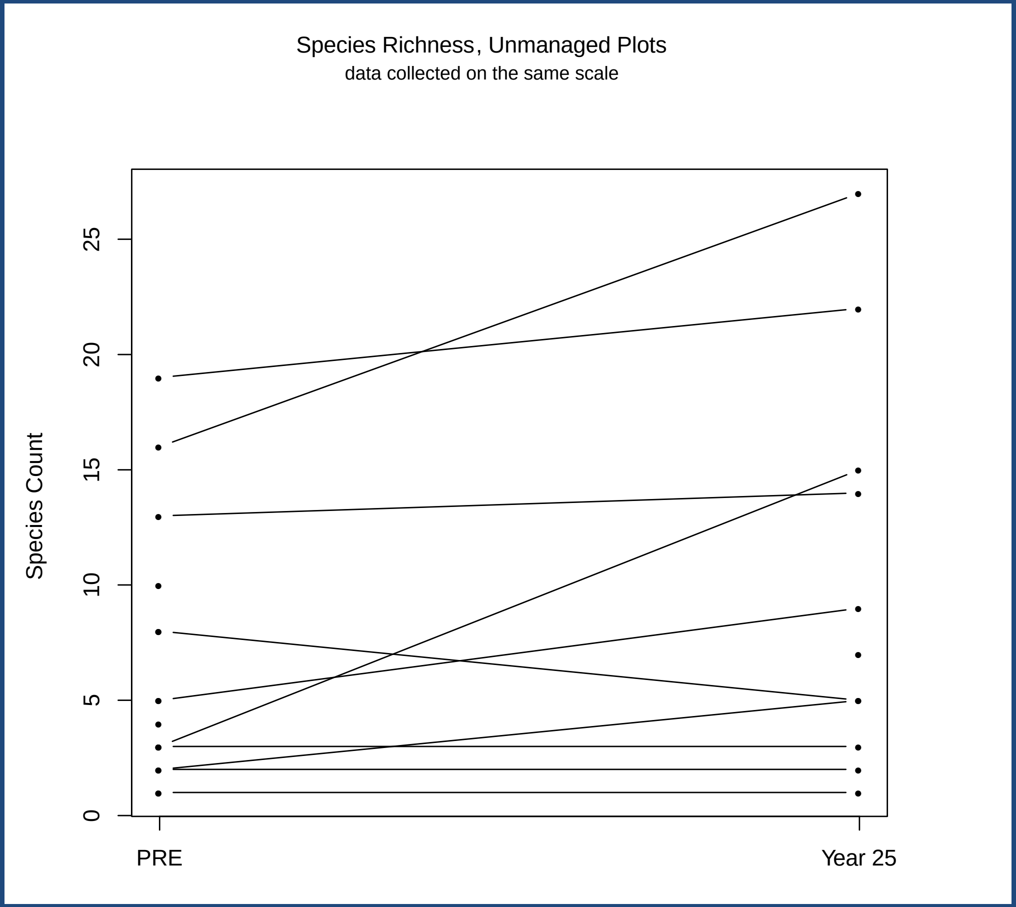
Luke J. Zachmann, Daniel W.H. Shaw, Brett G. Dickson

"Forest Recovery" from early 20th century disturbances context

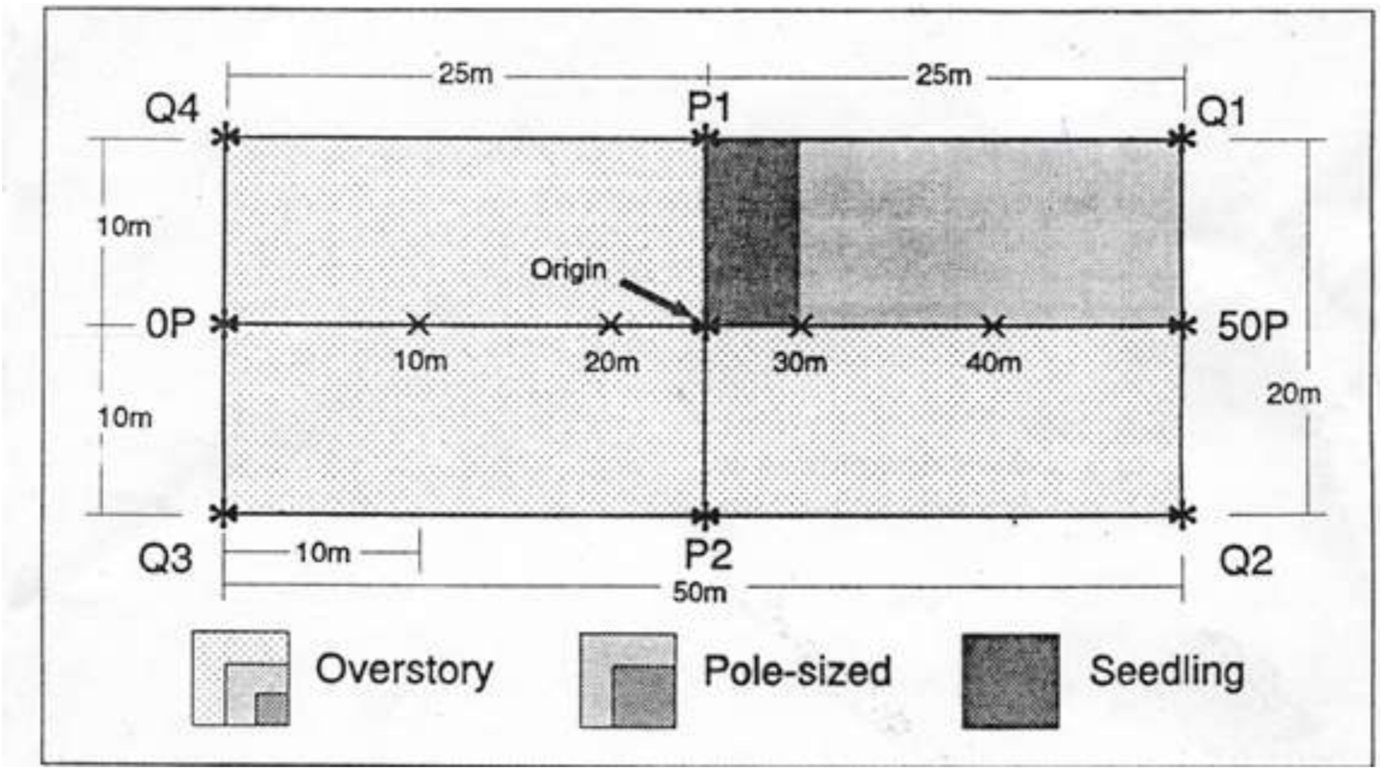
Table 3
Medians and 95% Bayesian credible intervals (indicated parenthetically) for the posterior distribution of the mean at each year as well as other derived quantities (i.e., year 0 vs year 20 differences).

Variable	Untreated plots			Treated plots		
	Year 0	Year 20	Difference	Year 0	Year 20	Difference
Tree density (trees × ha^{-1})	538 (453, 644)	421 (352, 504)	−118 (−147, −94)	504 (399, 618)	268 (212, 330)	−235 (−290, −185)
Quadratic mean diameter (cm)	34 (30, 38)	38 (34, 42)	3.9 (2.9, 5.2)	39 (30, 54)	47 (36, 64)	7.6 (4.1, 12)
Basal area (m^2 × ha^{-1})	48 (36, 65)	47 (35, 65)	−1.2 (−8.2, 6.1)	59 (34, 111)	38 (22, 72)	−20 (−52, −0.38)
Cover of understory vegetation	0.19 (0.054, 0.47)	0.28 (0.087, 0.6)	0.09 (0.031, 0.15)	0.081 (0.028, 0.25)	0.19 (0.07, 0.46)	0.1 (0.041, 0.21)

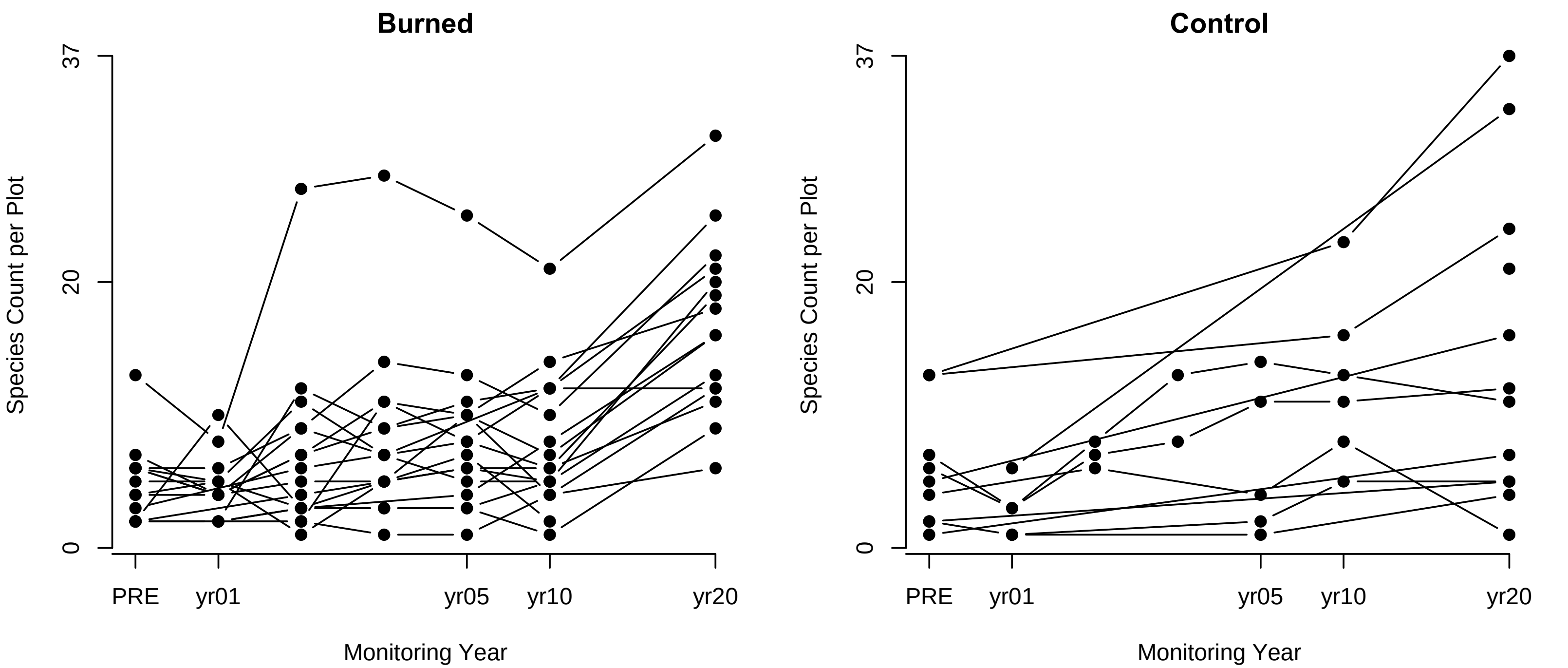
Results: Unmanaged Plots Pre-treatment and 25 years after



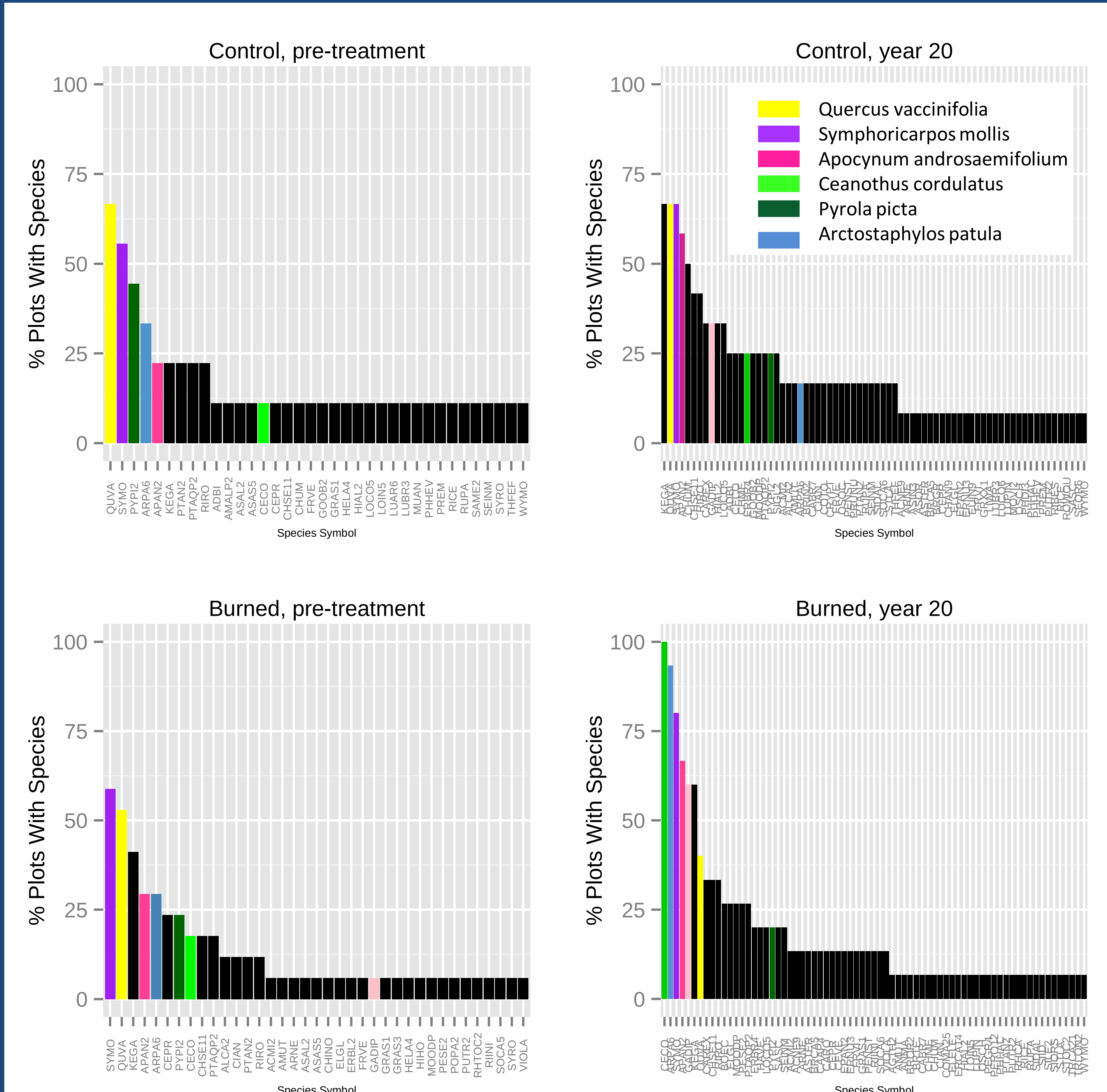
Methods and Plot Description



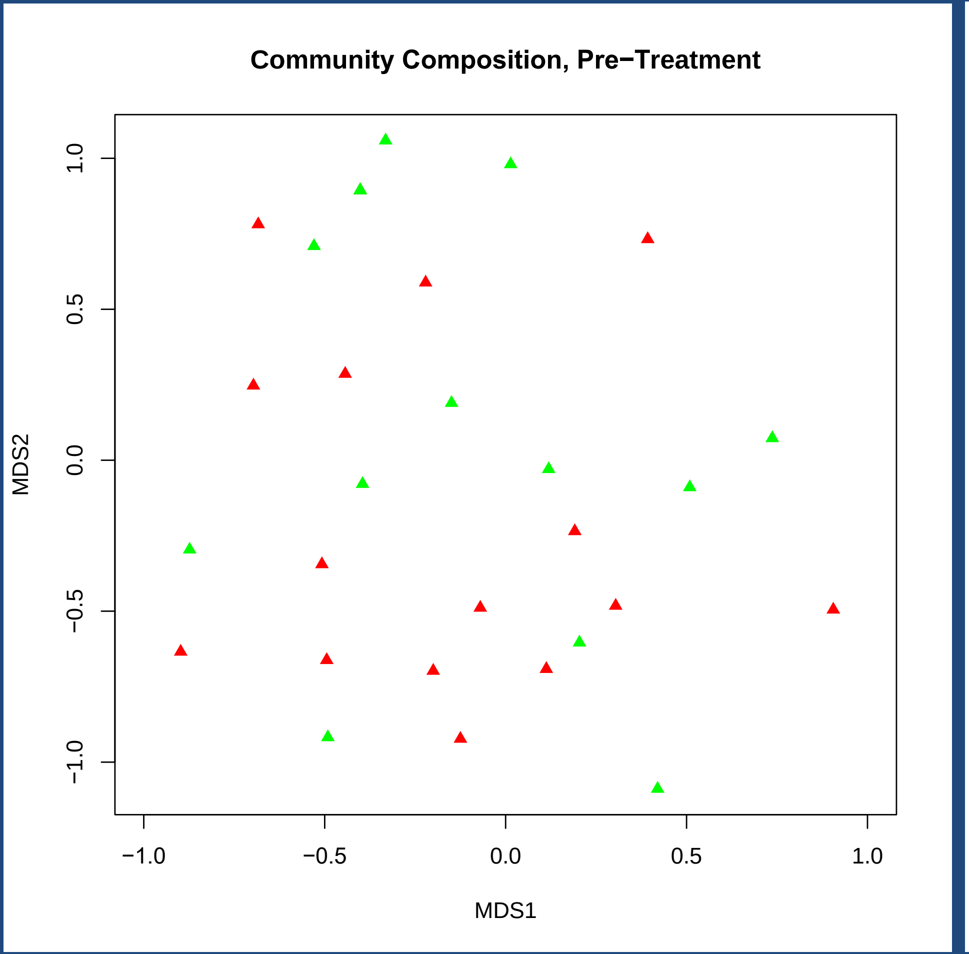
Plot-level species richness over time

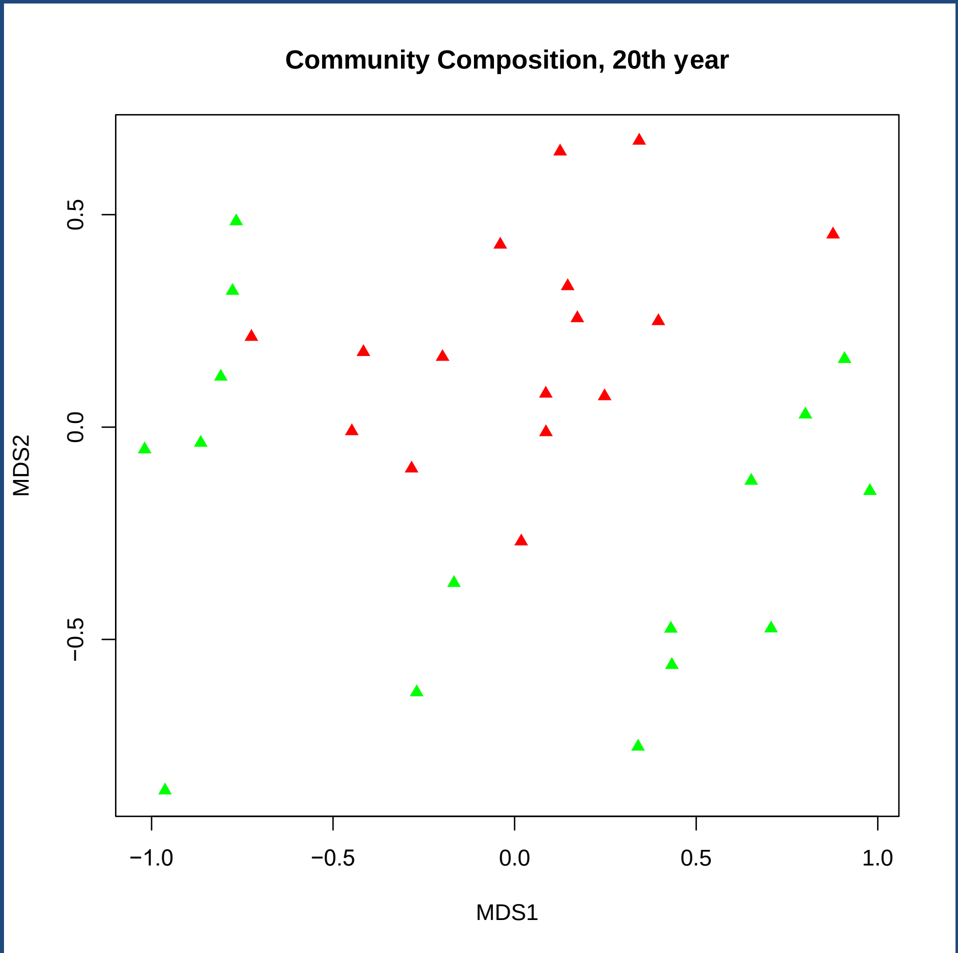


Wicoxon rank test:
Pre-treatment richness ($p = 0.54$)
20^{th} year richness ($p = 0.32$)

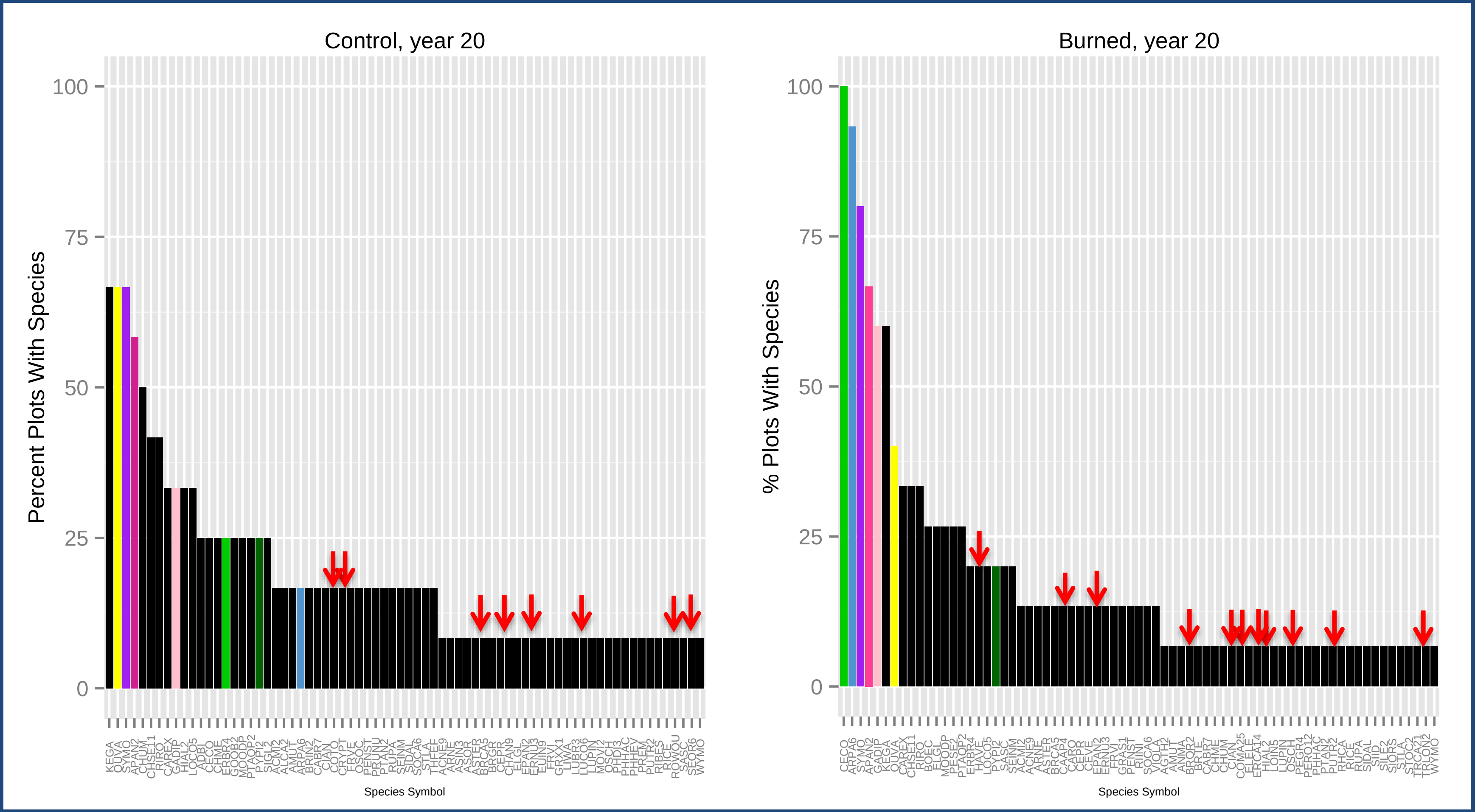

Control, pre-treatment
Control, year 20
Burned, pre-treatment
Burned, year 20
% Plots With Species
0
25
50
75
100
Species Symbol
Quercus vaccinifolia
Symphoricarpos mollis
Apocynum androsaemifolium
Ceanothus cordulatus
Pyrola picta
Arctostaphylos patula
QUVA SYMO PYPI2 ARPA6 APAN2 KEGA PTAN2 PTAQP2 RIRO ADBI AMALP2 ASAL2 ASAS5 CECO CEPR CHSE11 CHUM FRVE GOOB2 GRAS1 HELA4 HIAL2 LOCO5 LOIN5 LUAR6 LUBR3 MUAN PHHEV PREM RICE RUPA SAME2 SEINM SYRO THFEF WYMO
SYMO QUVA KEGA APAN2 ARPA6 CEPR PYPI2 CECO CHSE11 PTAQP2 ALCA2 CIAN PTAN2 RIRO ACMI2 AMUT ARNE ASAL2 ASAS5 CHINO ELGL ERBL2 FRVE GADIP GRAS1 GRAS3 HELA4 HIHO MOODP PESE2 POPA2 PUTR2 RHTOC2 RIINI SOCA5 SYRO VIOLA

Do both burned and unmanaged areas contribute to overall species richness?

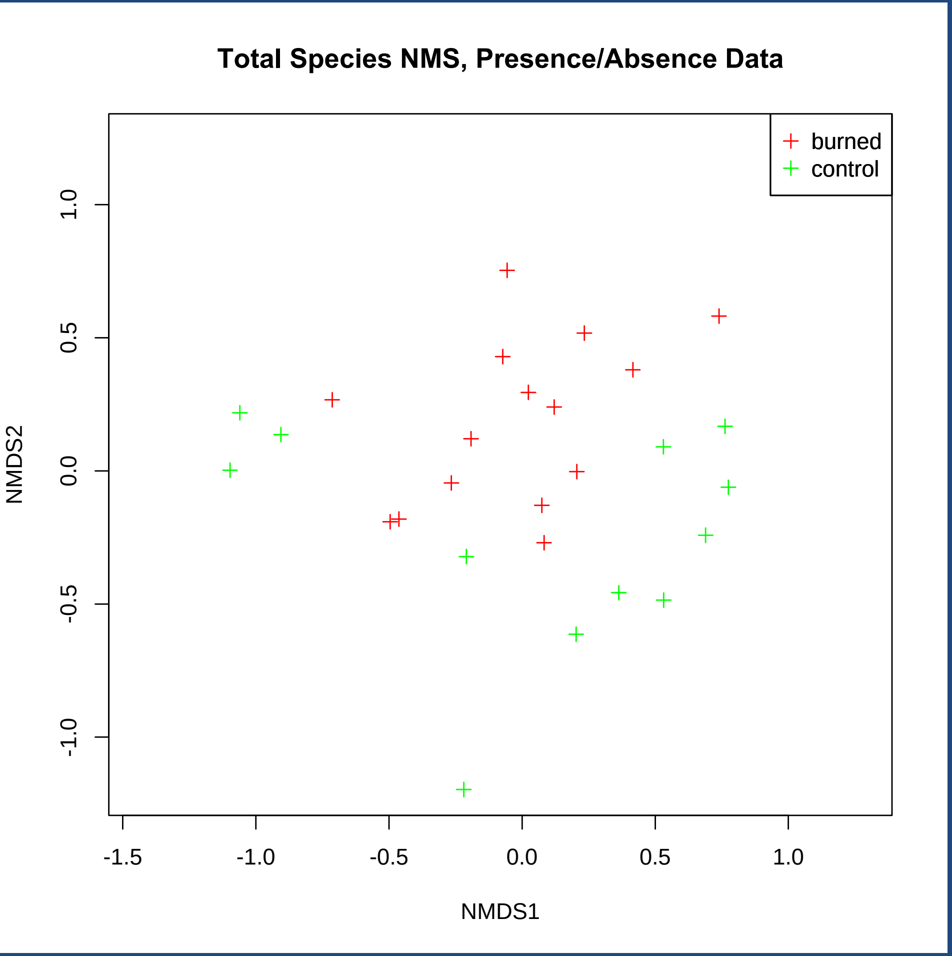




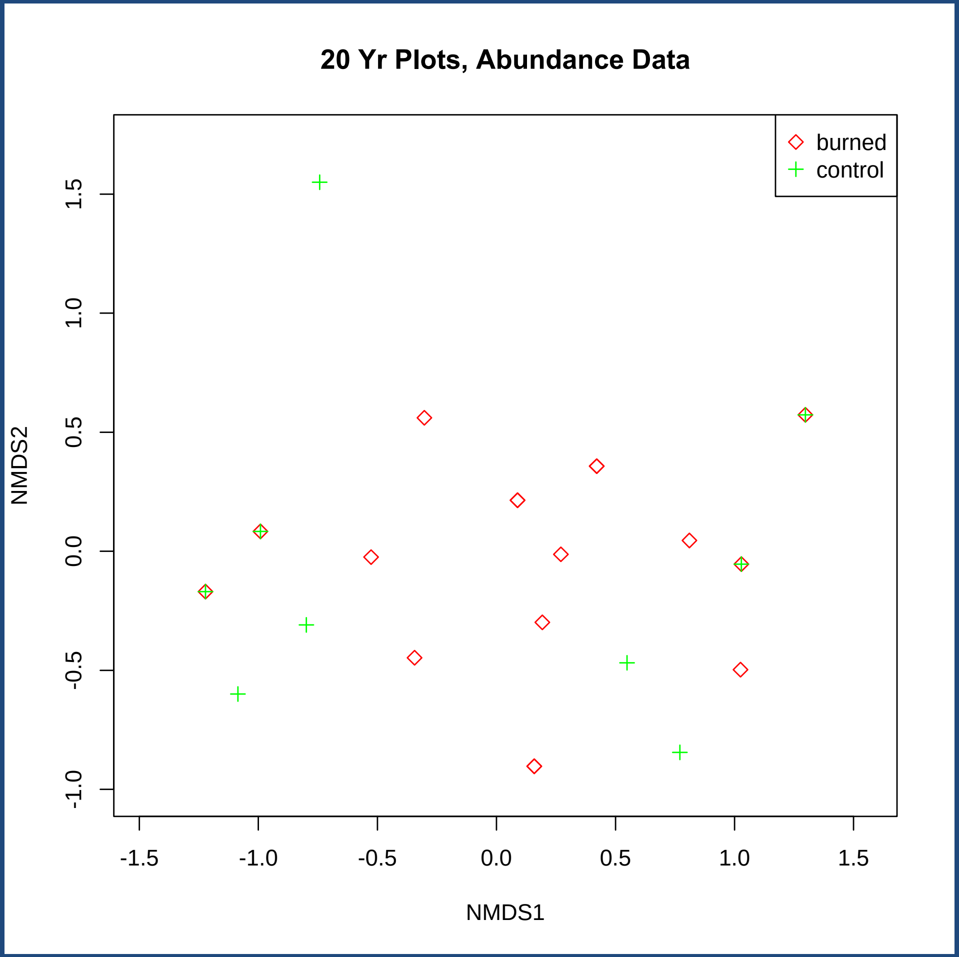
Unique species – found in burned or control plots only



Non-metric multidimentional scaling on data from year 20 (presence/absence)



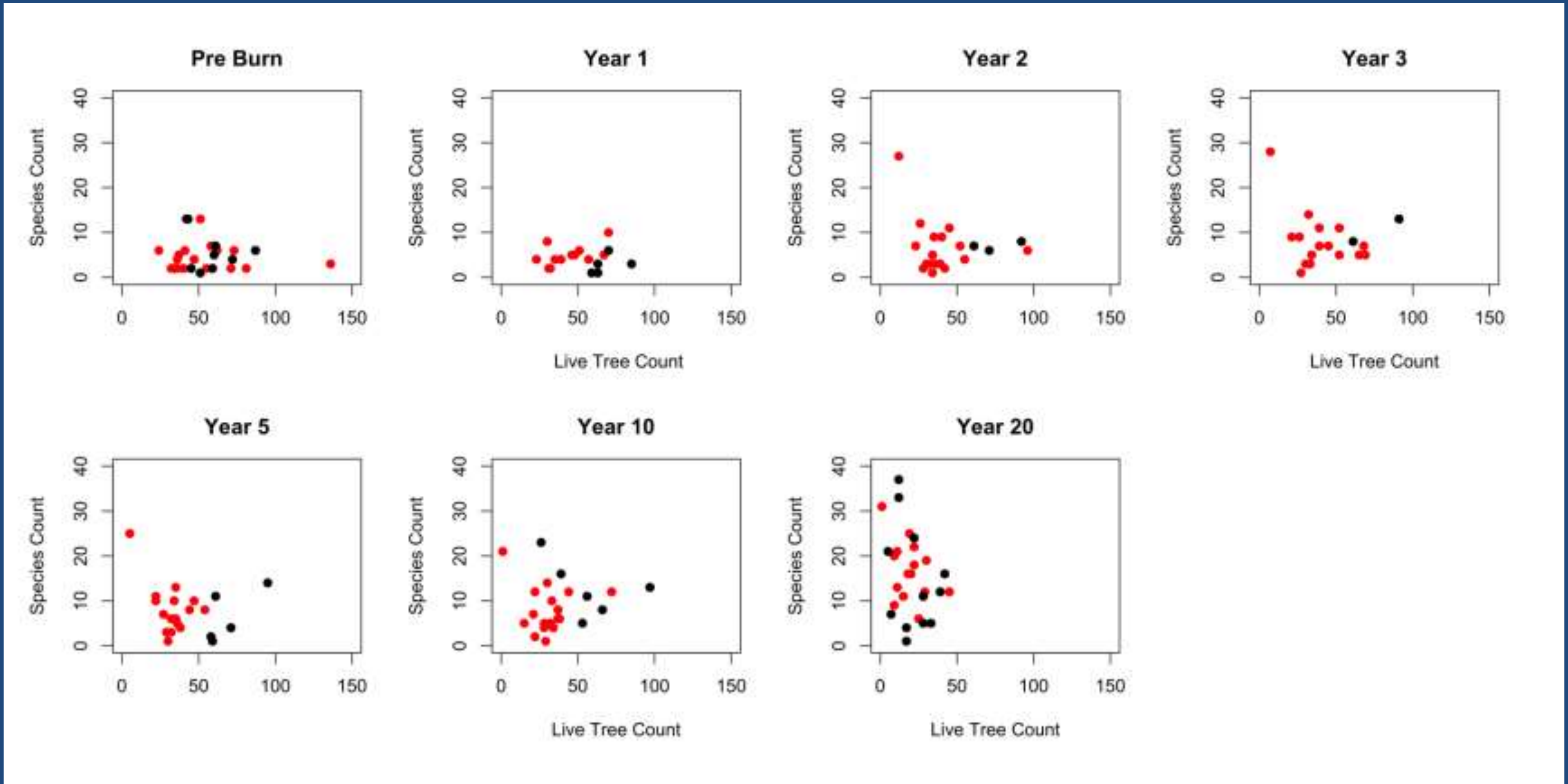
NMS on abundance data (partial species), year 20.



NMS Observations

- Burned plots seem to be more similar to each other than control plots (clustered in NMS plot)
  - reflection of the variation in control plot species richness?
  - Species rich control plots different in composition from burned plots? Look up individual plots.

Relationships between species counts and tree densities in burned and control plots



So what/speculations?

- Unmanaged forests are not always depauperate compared to those managed with fire
- Why is that?
  - Bias in plot location choice? Control plots were initially more dense and mesic, giving them species advantage?
  - Climate change signal/drought/water stress: tree self-thinning and subsequent increase in species richness that overrides/coincides with tree die-off in the burned plots?
- Species richness response to management/disturbance modified by water availability?

Next steps:

- Data quality control – make sure species are entered correctly
- Species that could have been confused with each other – write a script that corrects potential species ID mistakes by merging species level data to a single genus (e.g., mints, grasses, other forbs that may be confusing).
- Functional group analysis – divide species into functional groups – what question would that be answering – could divide the influence of fire vs influence of drought – fire-stimulated species vs light-stimulated species?
- Is increased species richness related to increased light availability or water (is there a net increase of available water as a result of tree die off?)

Stress vs Dimensionality for abundance-based NMS, year 20