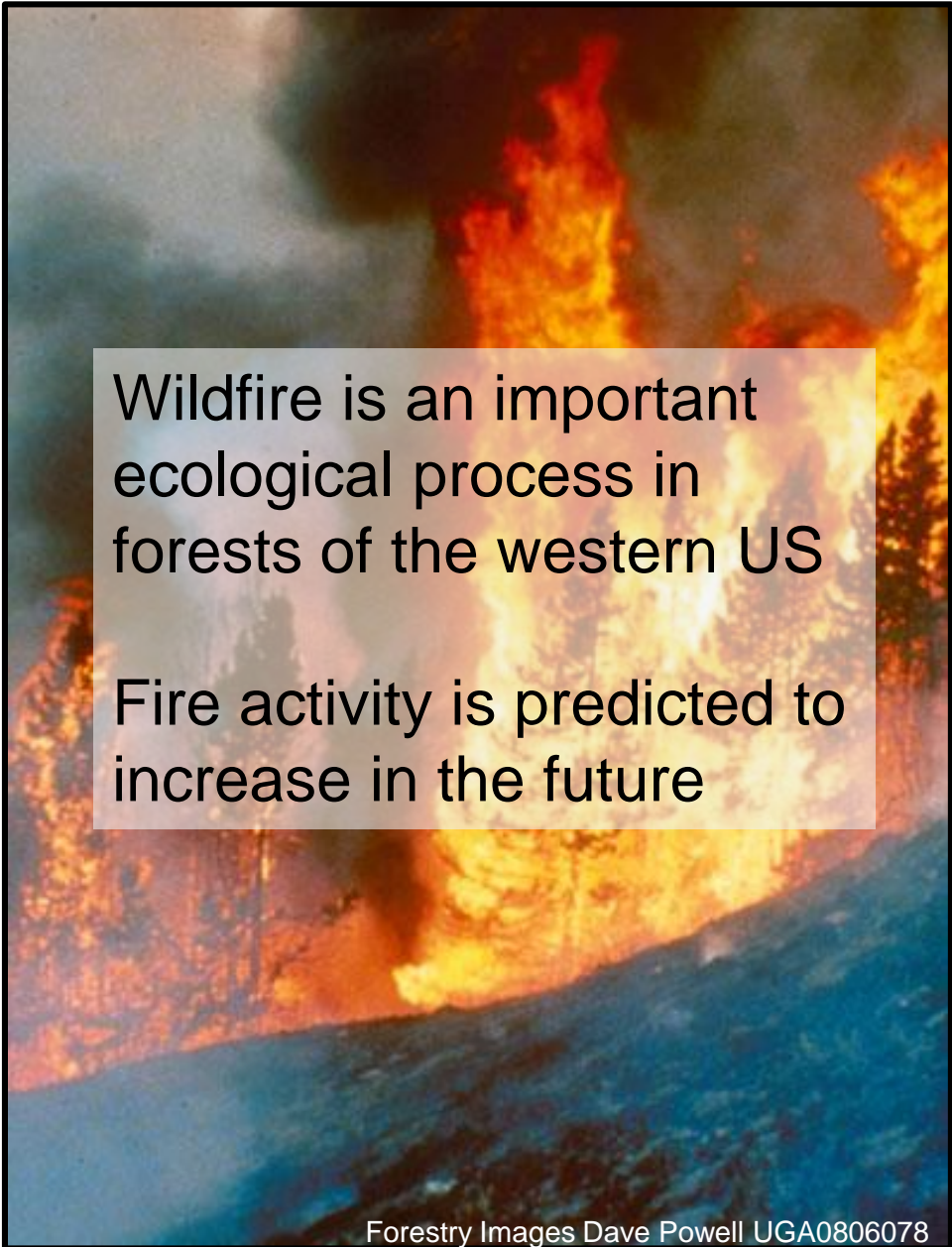


Does burn severity affect plant community diversity and composition in western conifer forests 10 years post-fire?

Eva K. Strand
Kevin L. Satterberg
Andrew T. Hudak
John Byrne
Alistair M.S. Smith

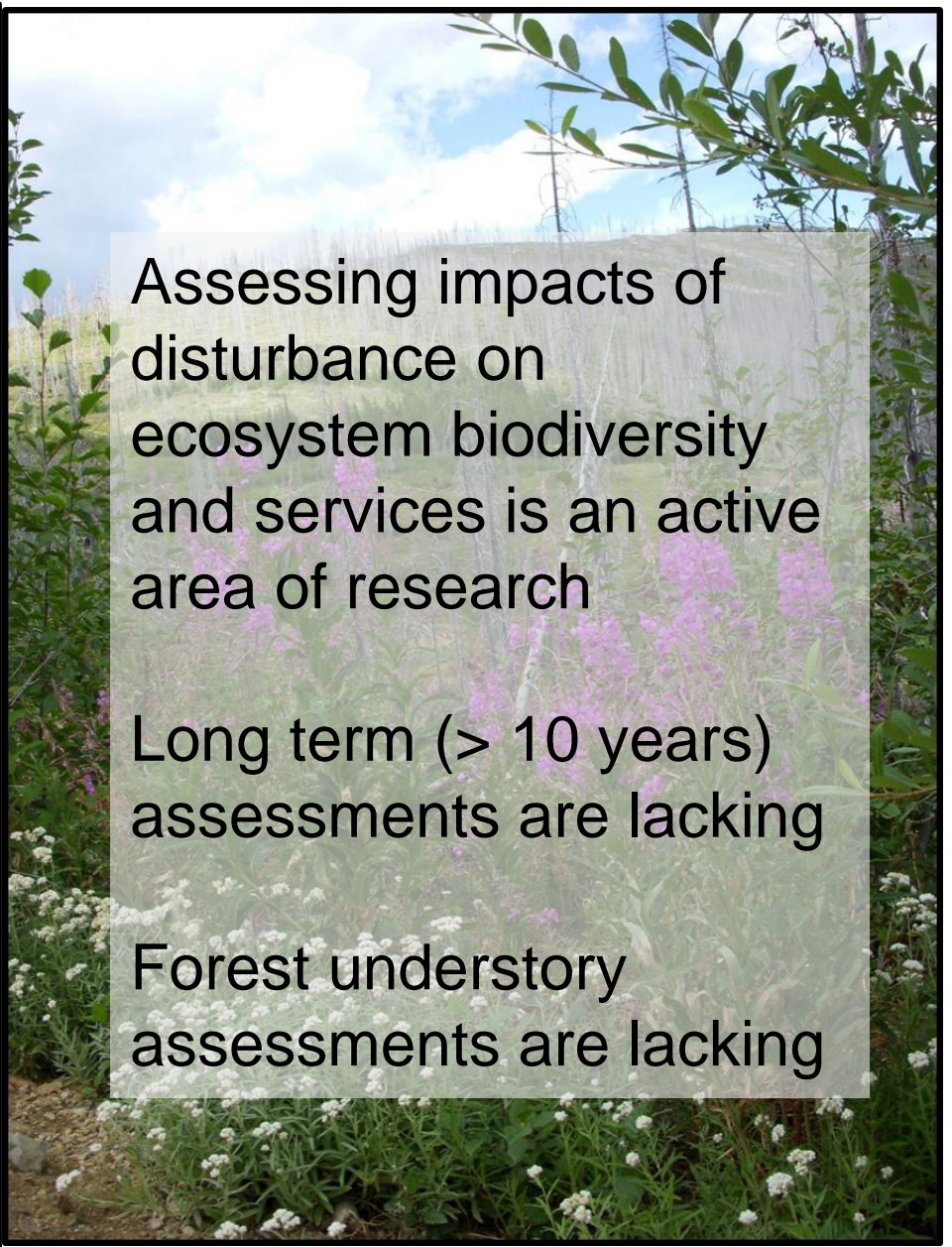


Purpose and motivation



Wildfire is an important ecological process in forests of the western US

Fire activity is predicted to increase in the future



Assessing impacts of disturbance on ecosystem biodiversity and services is an active area of research

Long term (> 10 years) assessments are lacking

Forest understory assessments are lacking

Five ecosystems – 15 fires

1) Subarctic boreal

2) Moist mixed conifer

3) Dry mixed conifer

4) Ponderosa pine

5) Conifer/oak/chaparral



Research question



Are there differences in the understory plant community diversity and composition based on climate, topography, and the satellite-based severity index (dNBR) ~10 years post-fire?

Moist Conifer Forest



Trees

Engelmann spruce
Lodgepole Pine
Subalpine fir
Western larch

Shrubs

Ninebark
Snowberry
Snowbrush
Willow sp.
Spirea
Thimbleberry
Huckleberry
Vaccinium sp.

Herbaceous

Arnica
Fire weed
Oregon boxleaf
Bear grass
Pinegrass
Bluegrass sp.
Sedges

Dry Conifer Forest



Photo: Ben Bright

Trees

Douglas-fir
Grand fir
Lodgepole Pine
Subalpine fir
Western larch

Shrubs

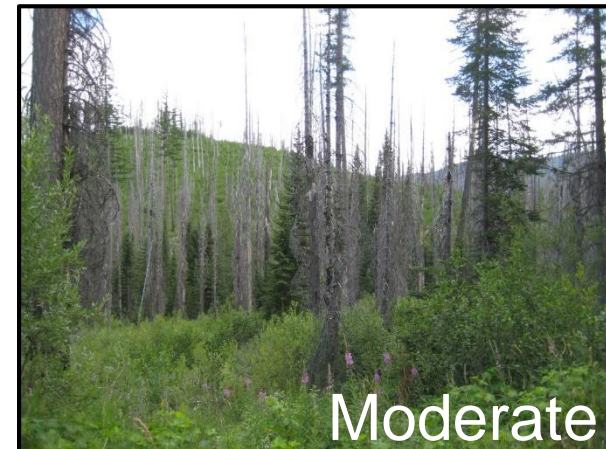
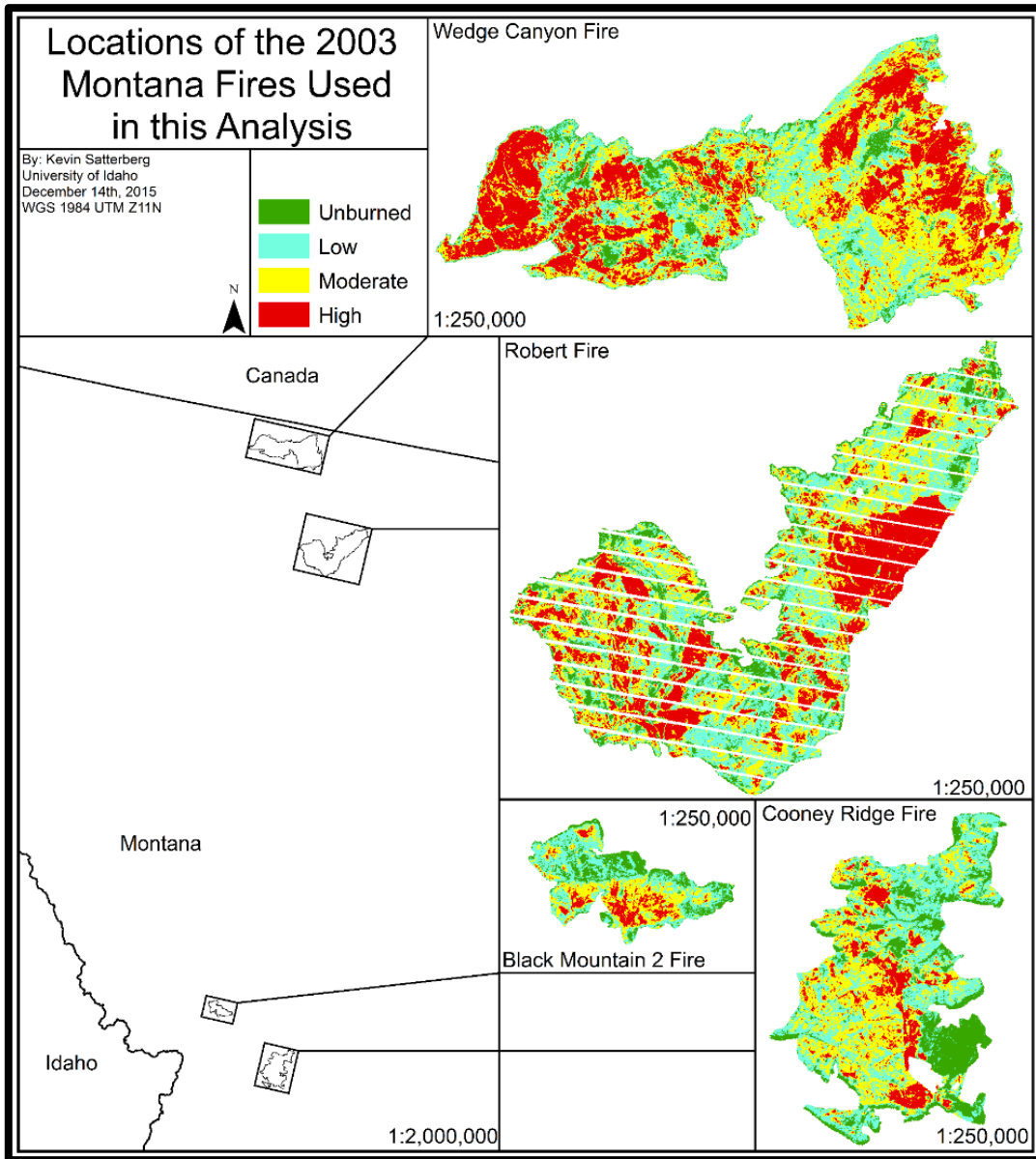
Ninebark
Snowberry
Snowbrush
Willow sp.
Spirea
Huckleberry
Vaccinium sp.

Herbaceous

Arnica
Fire weed
Aster sp.
Penstemon sp.
Bear grass
Pinegrass
Bluegrass sp.
Bluebunch wheatgrass
Fescue

Dry Conifer Forest





Field data collection

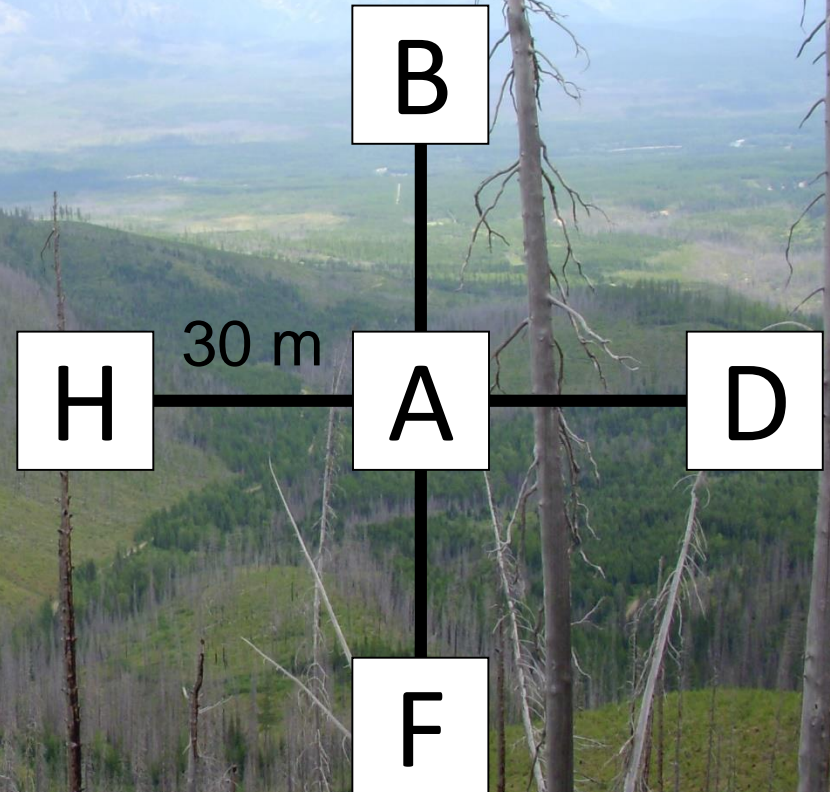
Stratification by

- Burn severity index
(Unburned, Low, Mod, High)
- Elevation
- Aspect

Sites

- Moist conifer forest: 37
- Dry conifer forest: 53

Understory species cover (%) was recorded in five 1-m quadrats and averaged to the site

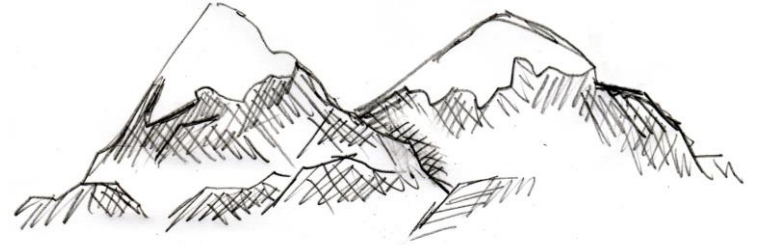


Explanatory variables

Topography

Elevation

Transformed aspect



Climate (30 year normals)

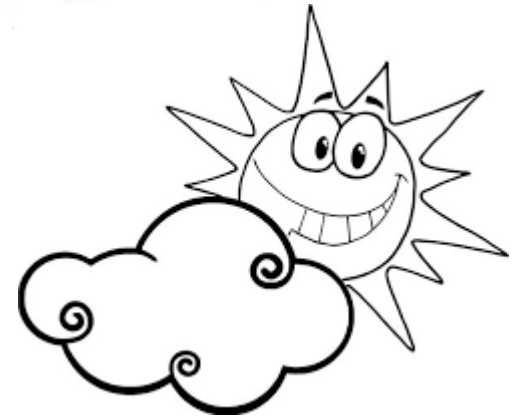
Mean annual temperature (mat)

Mean annual precipitation (map)

Summer precipitation (smrpb)

Julian day of last frost in spring (sday)

Degree-days (mmindd0)



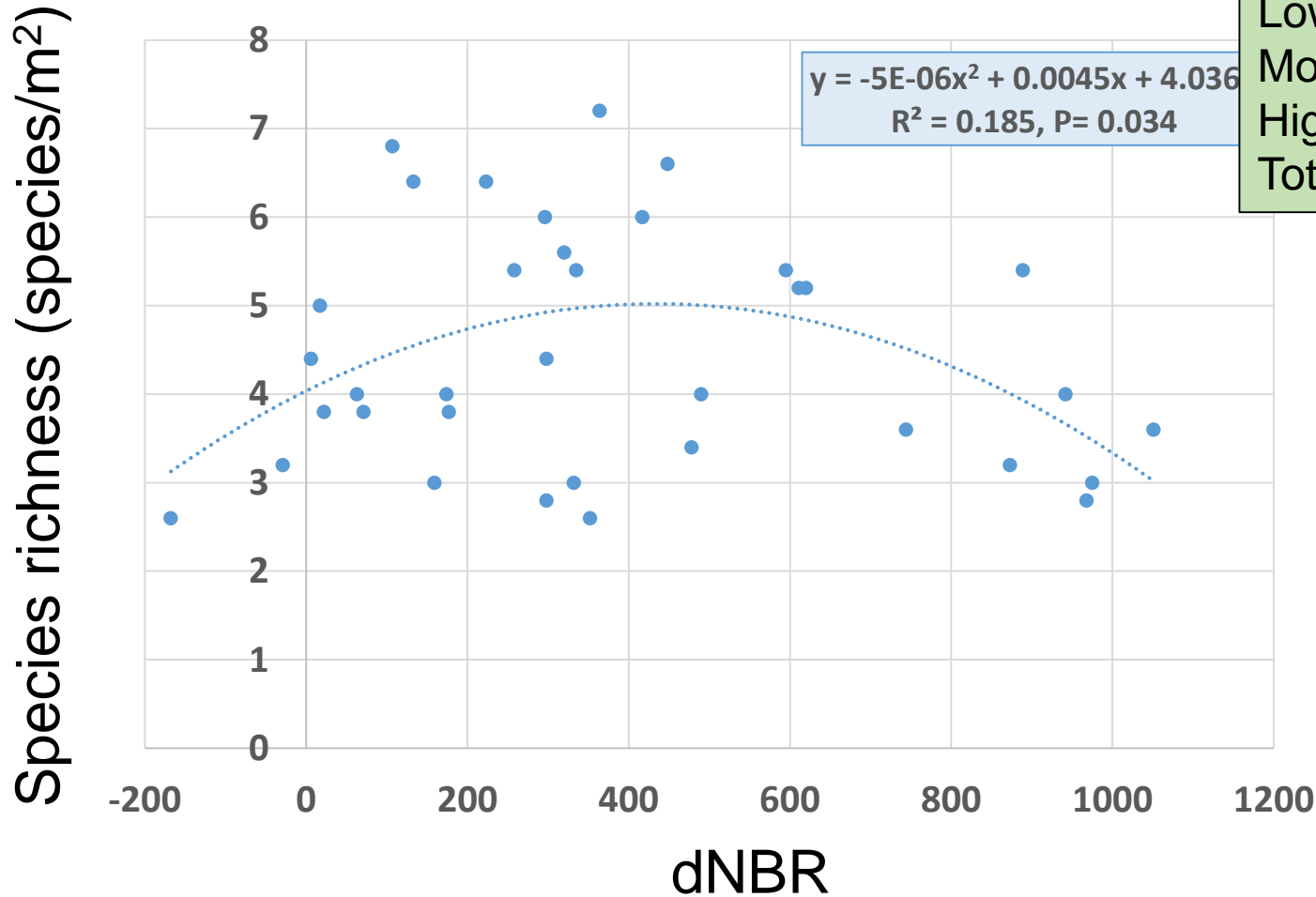
Fire

Remote sensing index (dNBR)



Understory Species Richness

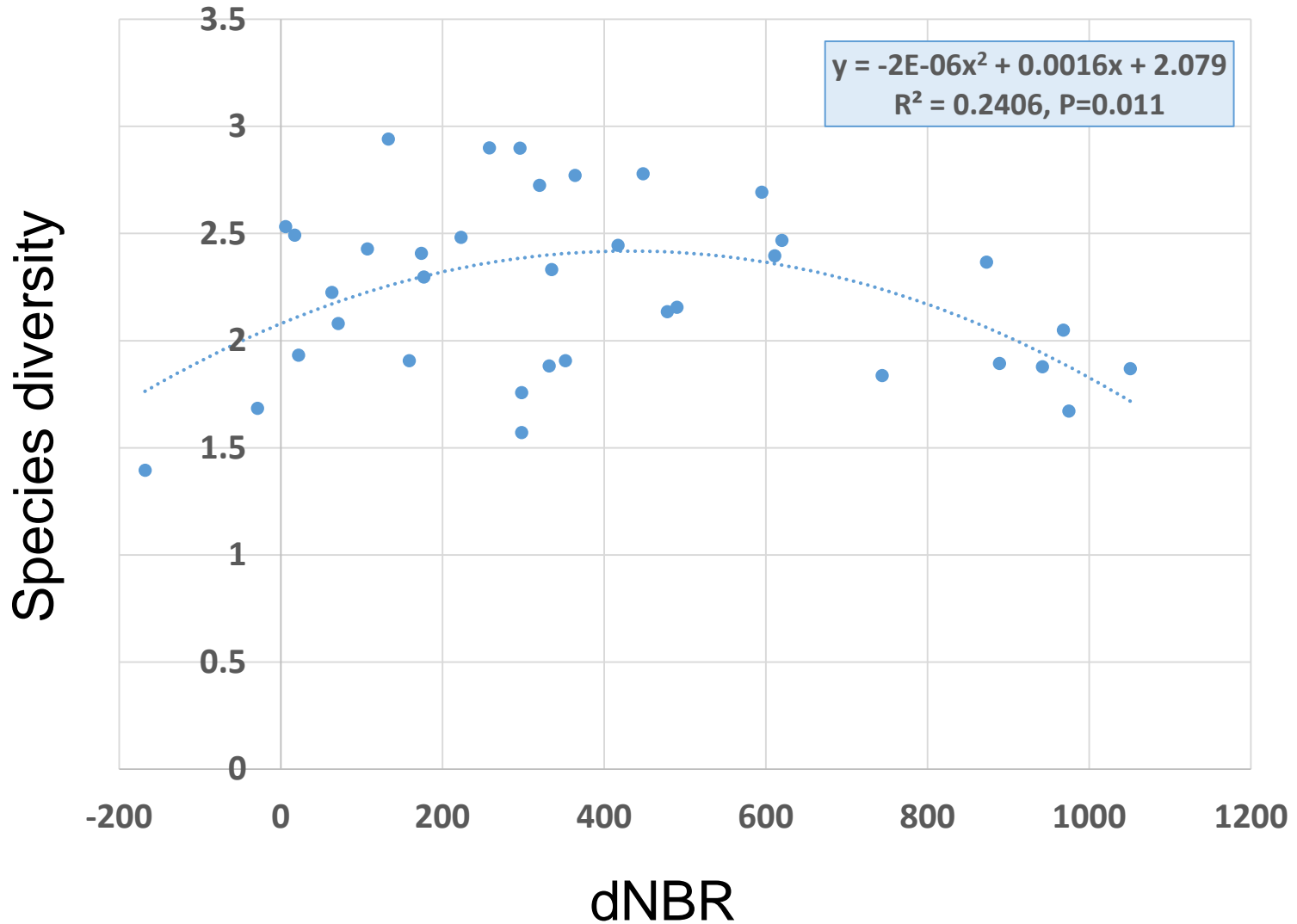
Moist conifer



	Total	Only
Unburn:	59	13
Low:	99	24
Mod:	131	43
High:	67	14
Total:	187	

Understory Diversity

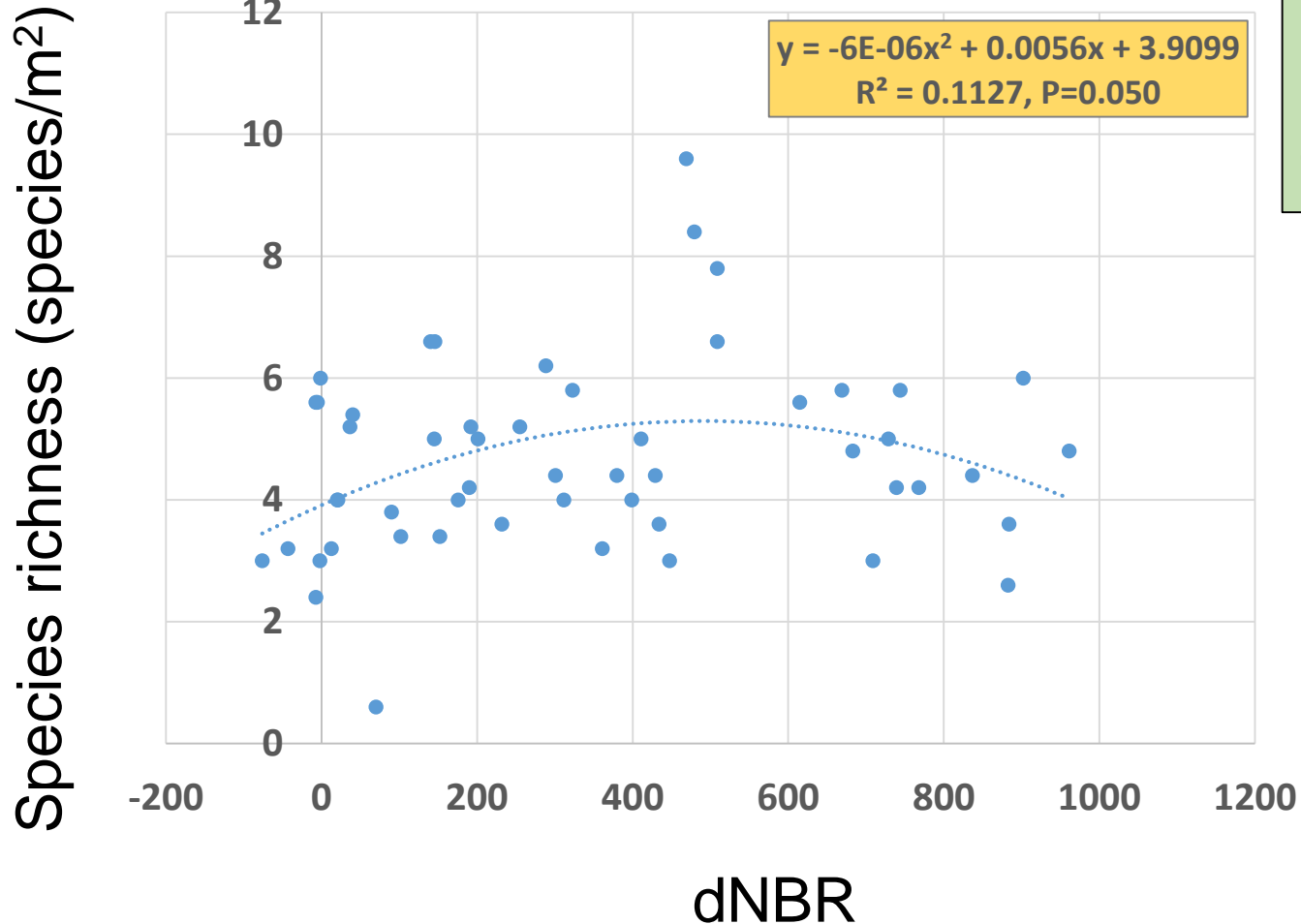
Moist conifer



Understory Species Richness

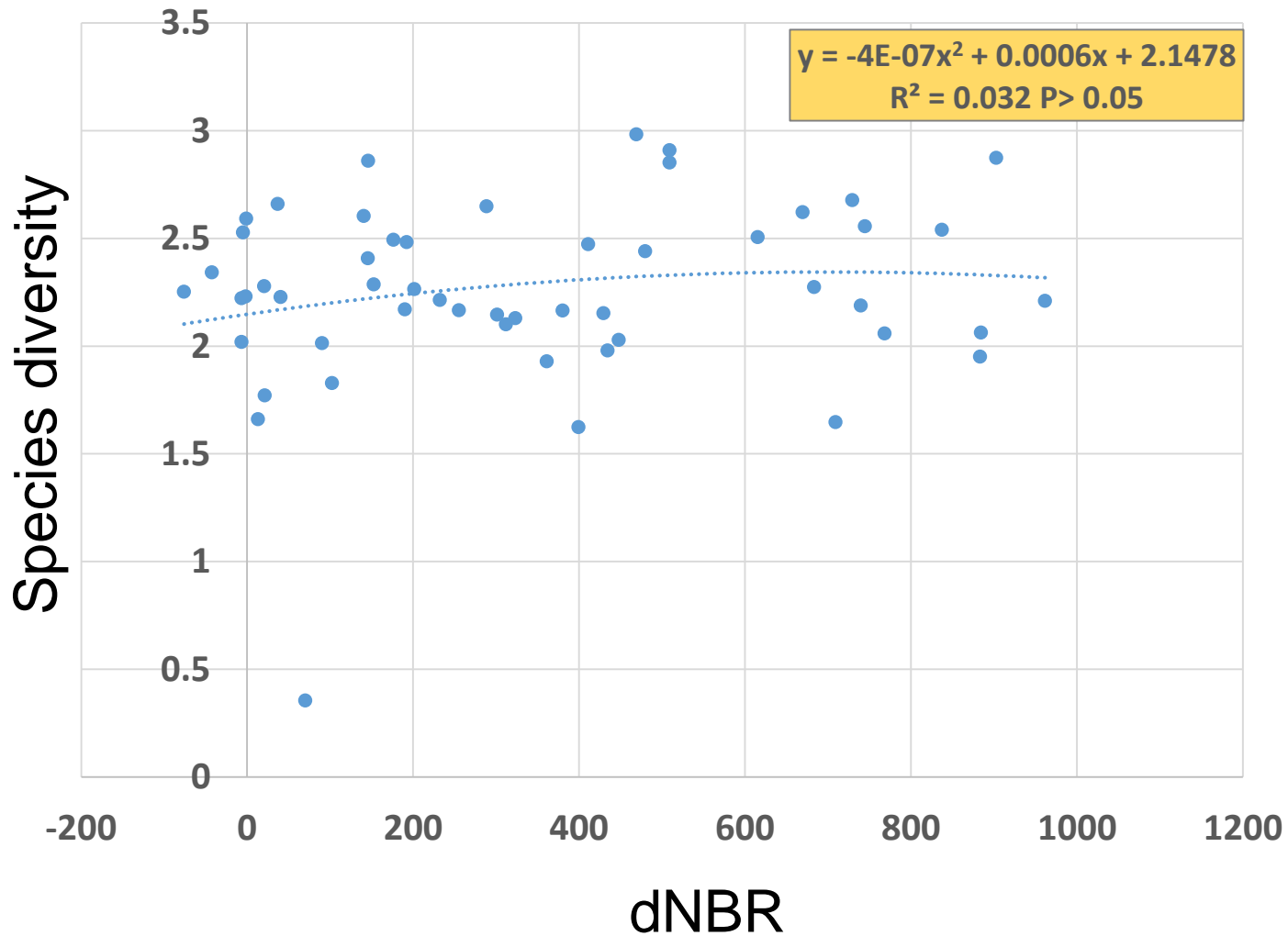
Dry conifer

	Total	Only
Unburn:	109	24
Low:	136	27
Mod:	147	21
High:	108	14
Total:	220	



Understory Diversity

Dry conifer



Intermediate Disturbance Hypothesis

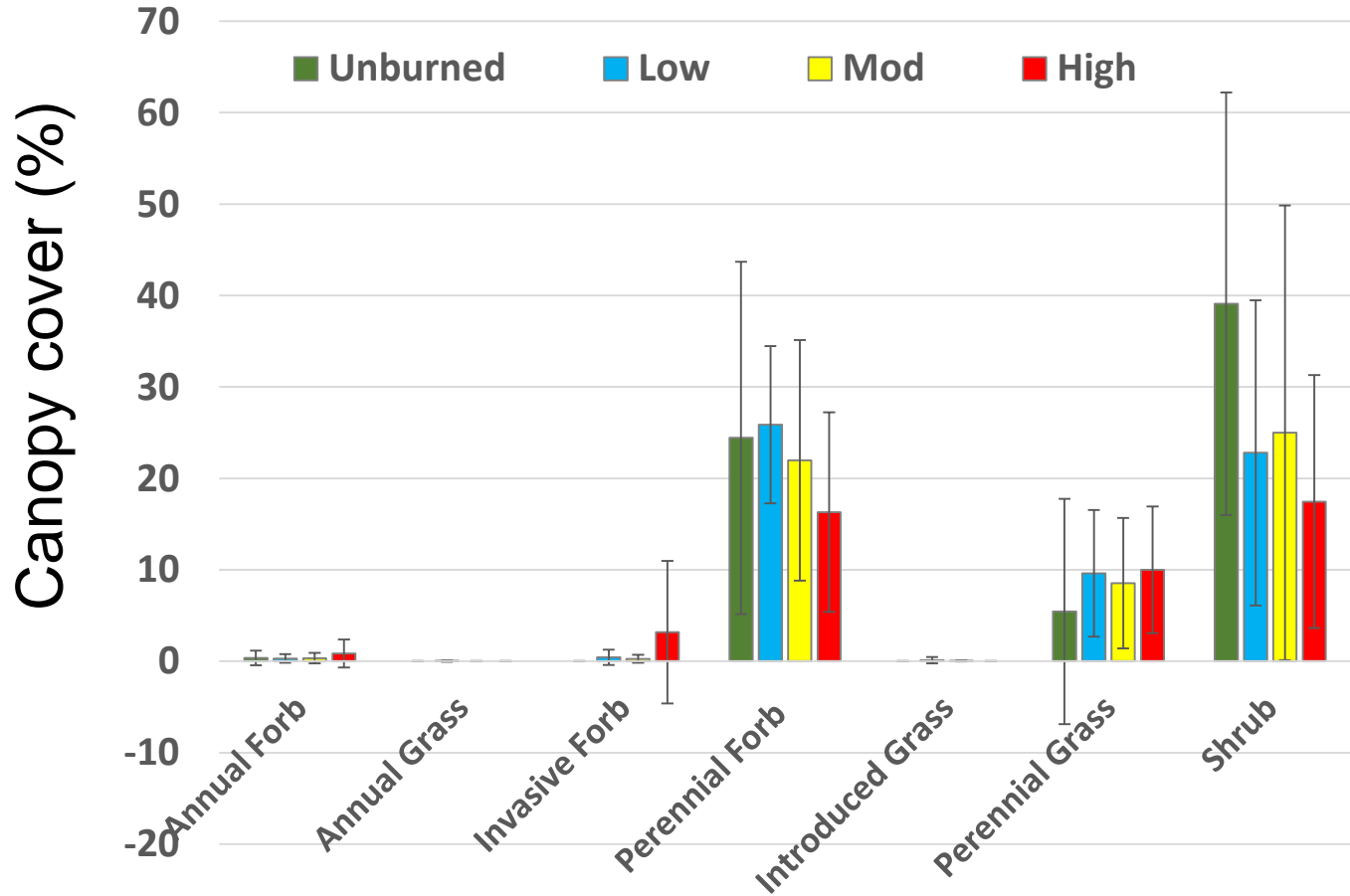
The **intermediate disturbance hypothesis (IDH)** suggests that local species diversity is maximized when ecological disturbance is neither too rare nor too frequent.

Results suggest that the IDH also applies to severity

Variable severity contributes to landscape patch diversity, which appear to contribute to overall landscape species diversity (gamma diversity).

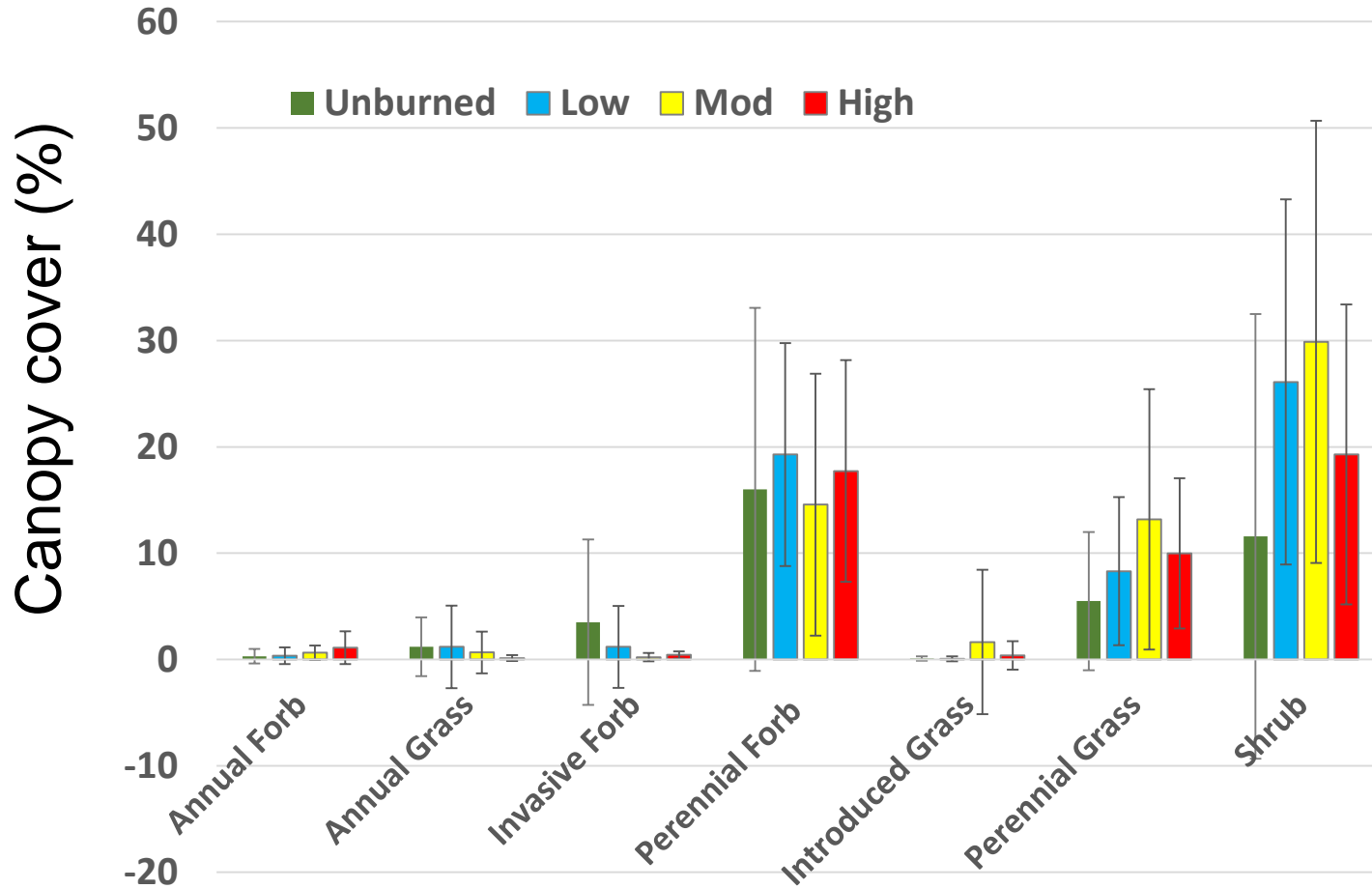
Understory Functional Groups

Moist conifer



Understory Functional Groups

Dry conifer

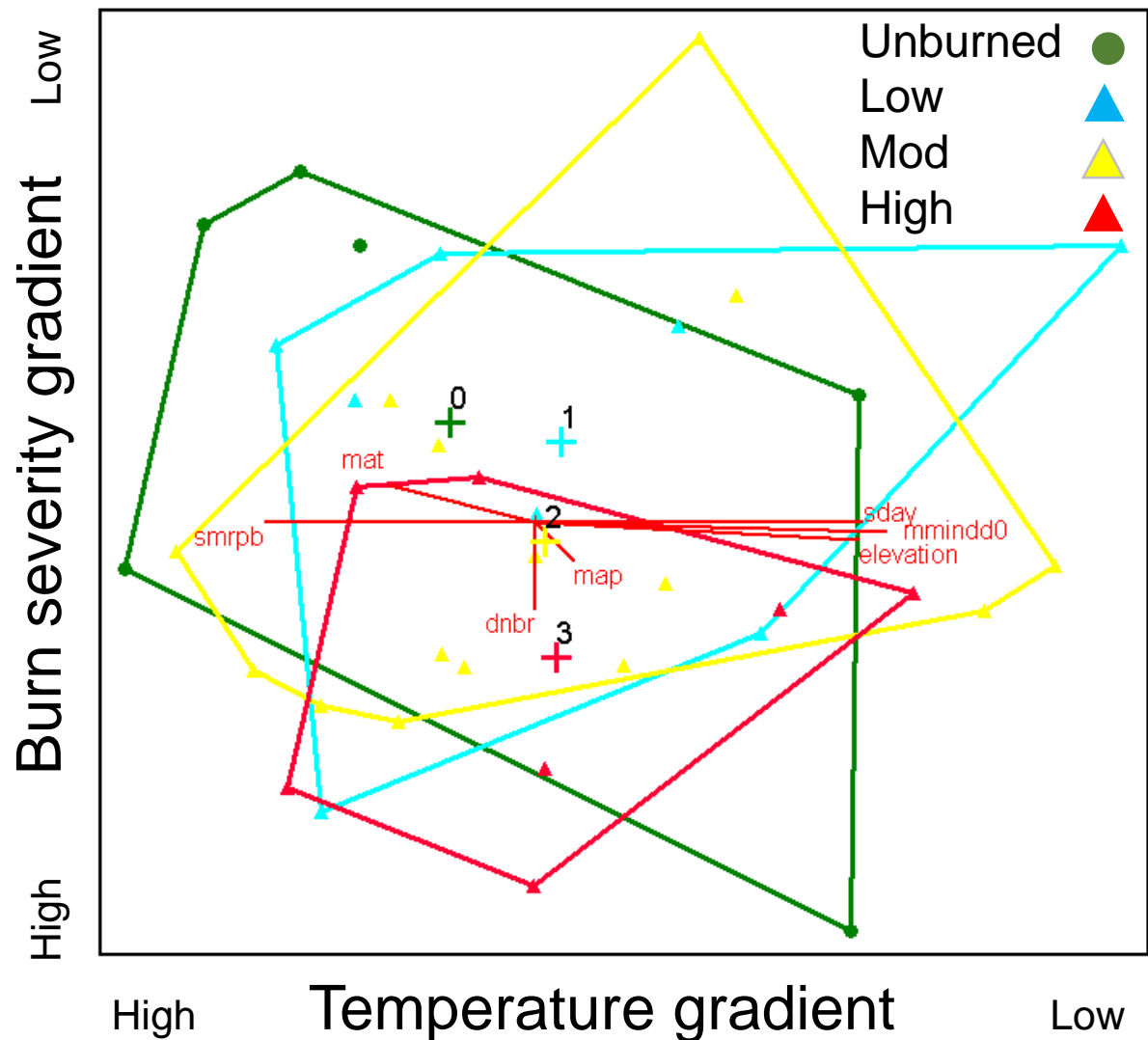


Climate, topography, fire

Moist conifer

Non-metric
multidimensional
scaling solution
with 3 dimensions
explaining 70% of
variation

- 1 33.1 %
- 2 20.6 %
- 3 16.5 %

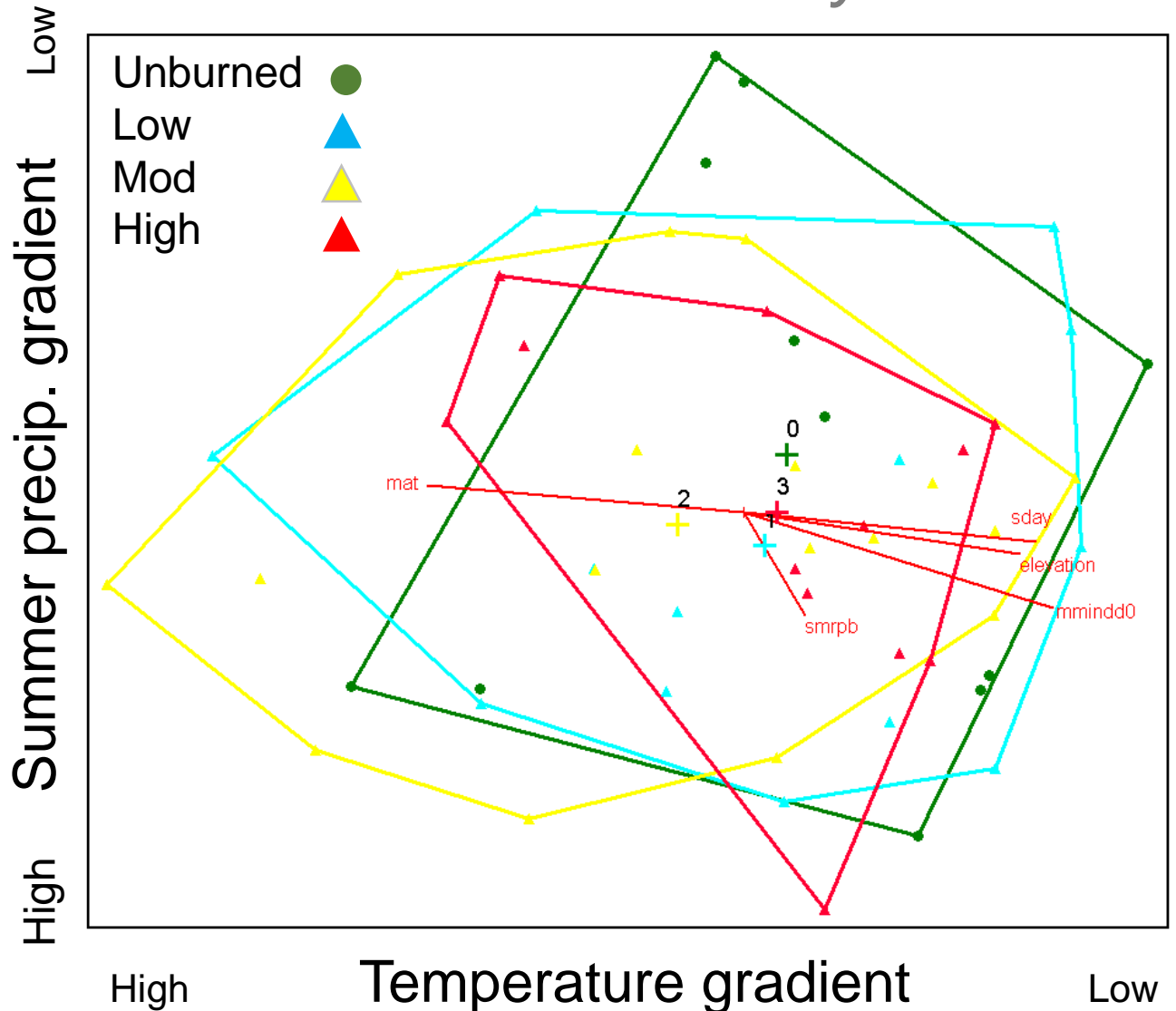


Climate, topography, fire

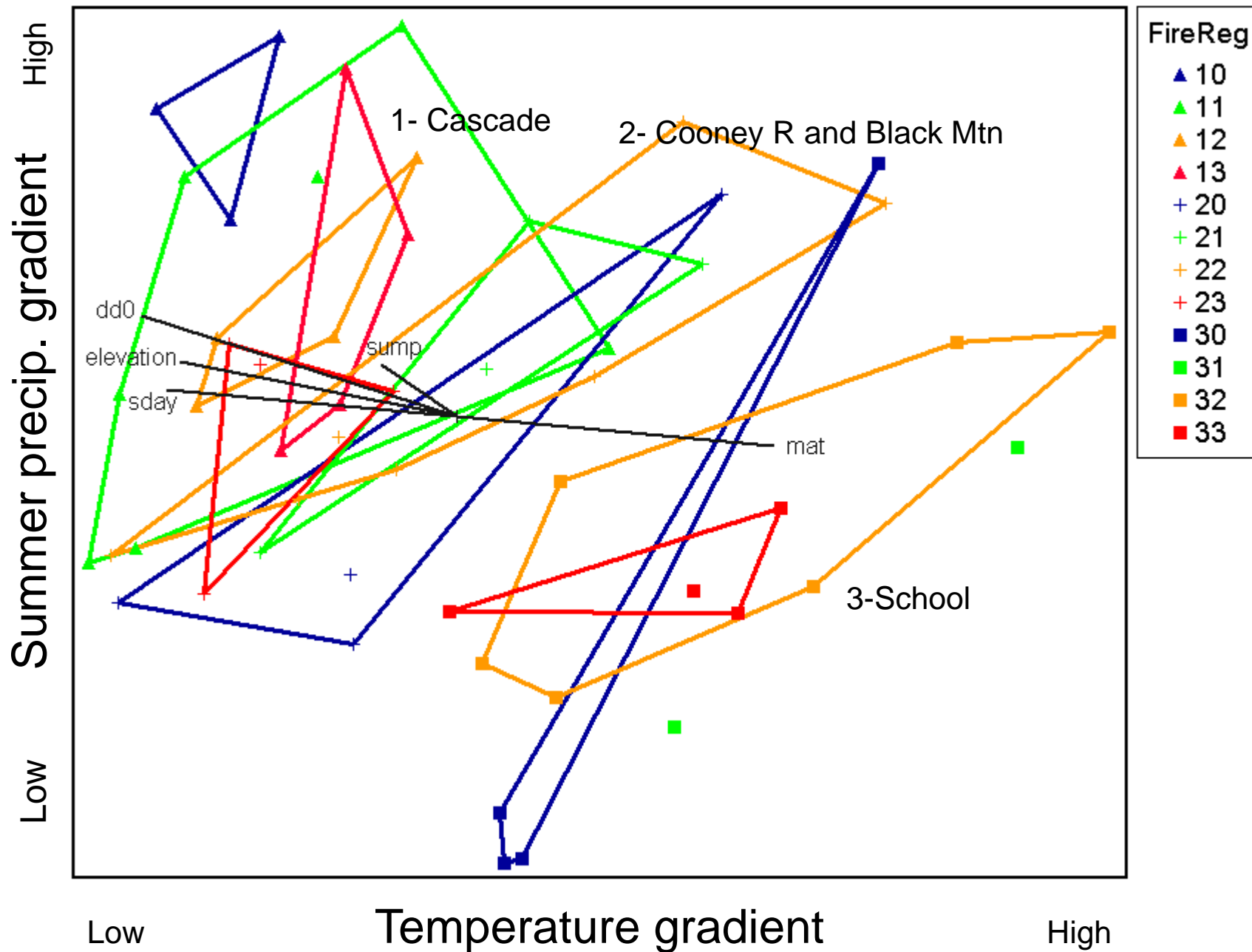
Dry conifer

Solution with 3 dimensions explaining 66% of variation

- 1 28.8 %
- 2 21.5 %
- 3 15.2 %



DryOrdination



Indicator species

Statistic: Dufrêne & Legendre test $P < 0.10$

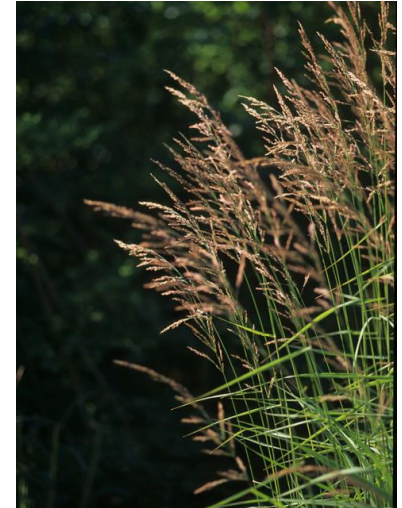
Moist conifer

Unburned: Bluejoint reedgrass (*Calamagrostis Canadensis*)

Low: Starry false Solomon's seal, Sweet cicely, One-sided wintergreen, Prince's Pine, Queen cup breadlily, Prickly currant, Thimbleberry

Moderate: Rocky Mountain Maple

High: Fire weed



Indicator species

Statistic: Dufrêne & Legendre test $P < 0.10$

Dry conifer

Unburned: Rattlesnake plantain, Fernleaf
biscuitroot, Single delight



Low: Sandwort sp., Virginia strawberry,
Sitka valerian



Moderate: Hieracium sp., Western larch

High: Snowbrush



Conclusions

- Non-linear relationship between species diversity and burn severity index (dNBR) – supports IDH
- Understory dominated by shrubs, perennial forbs and grasses
- Very few introduced or noxious species across at all severity levels; more in dry forest
- Strong climate gradient in moist and dry forest
- Burn severity gradient in moist conifer forest 10 yr post-fire but not in dry
- Overlap in species composition between unburned and burn severity levels
- Severity levels contributes to landscape level diversity

Thank you!

