

Spatial and temporal patterns of vegetation treatments in the Southwest: variability and trends with implications for restoration success

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Restoration Assessment & Monitoring Program for the Southwest (RAMPS)



Restoration goals, and challenges in the Southwest US

Major Restoration Goals

- Restore ecosystem function and biodiversity
- Promote resilience to disturbance



Photo: Michael Duniway

Challenges

- Profound effects of land-use on ecosystem processes
- Severe and frequent fire
- Invasive species
- Climate change drying and variability → high probability of restoration failure?



Photo: Michael Duniway

What conditions and management techniques are likely to lead to greater restoration and rehabilitation success?

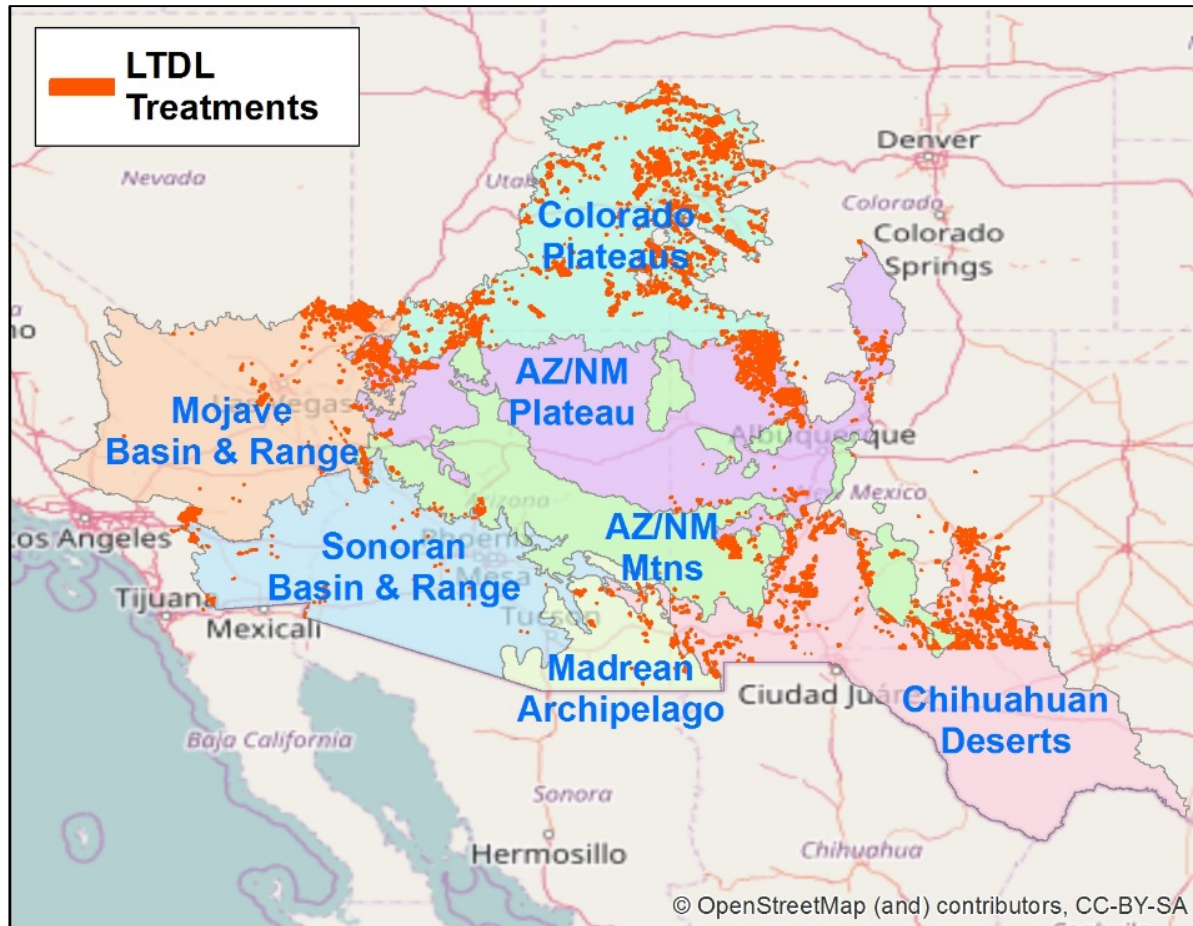
Past restoration and rehabilitation treatments may provide insight on changing practices, costs, and avenues for improvement

- What are the trends in landscape treatments related to restoration and rehabilitation in the Southwest?
- How do these trends relate to elements of successful restoration (or not)?



Core Dataset: Land Treatment Digital Library (LTDL)

- Compiled by David Pilliod & Justin Welty available at: <http://ltdl.wr.usgs.gov>
- BLM lands only



From 1940 to 2015

Projects: 2542

Treatments: 3983

Treatments with spatial data: 60%

Treatments with recorded objectives: 30%

Seeding treatments with species data: 16%

Climate and vegetation type data & methods

- Four climate variables (4 km, PRISM): Total precipitation, precipitation in the driest quarter of the year, mean annual temperature, and temperature of the warmest quarter
- Compared climate of year of treatment and following treatment to 5 years + or – the treatment period
- Area of dominant vegetation types with LANDFIRE existing vegetation type (EVT, 30 m resolution)

Restoration/rehabilitation or resource extraction objectives

Classified objectives with key words into four categories

- restoration, resource extraction, combination, or uncategorized

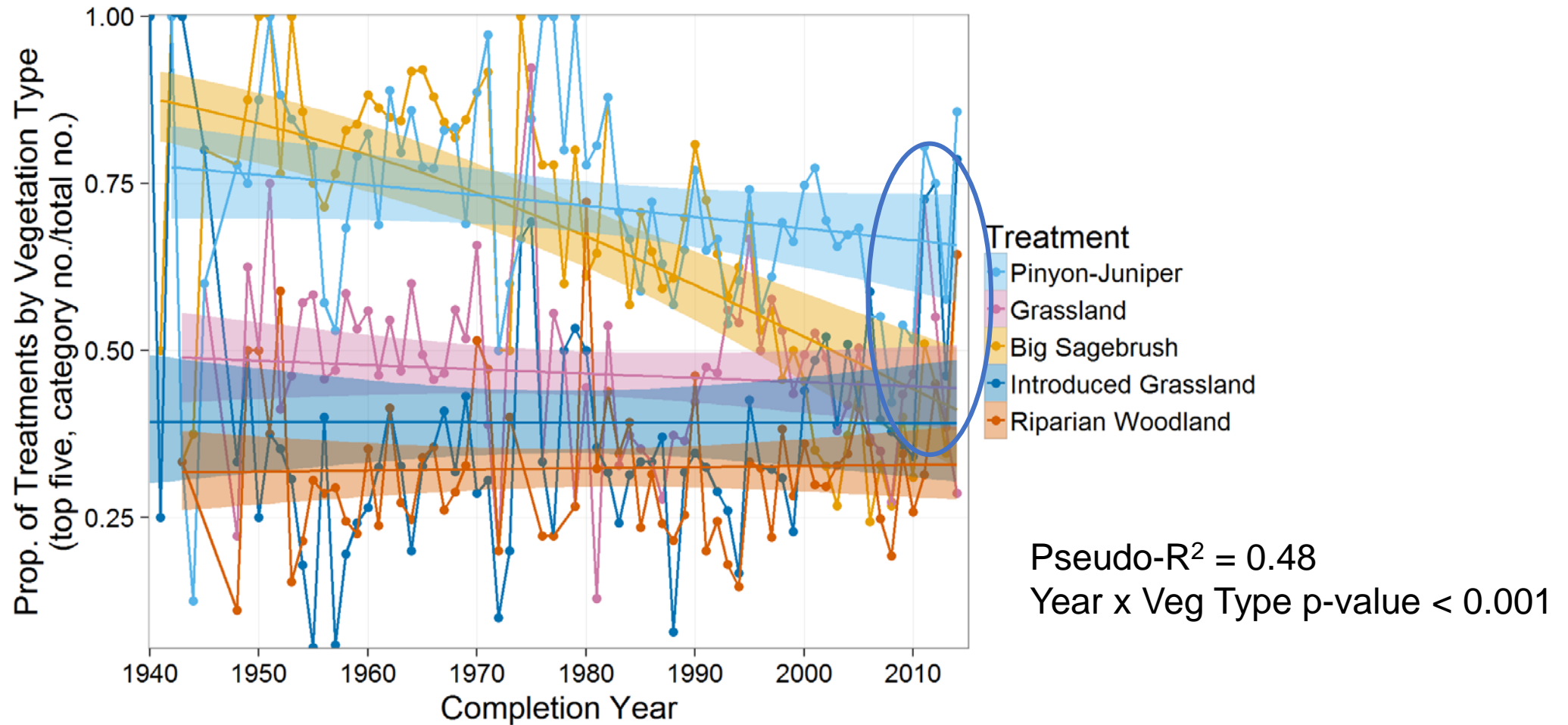
Restoration key words

- erosion, restor*, rehab*, invad*, invas*, native, noxious, cheatgrass, diversity, grouse, habitat, tortoise, and wildlife

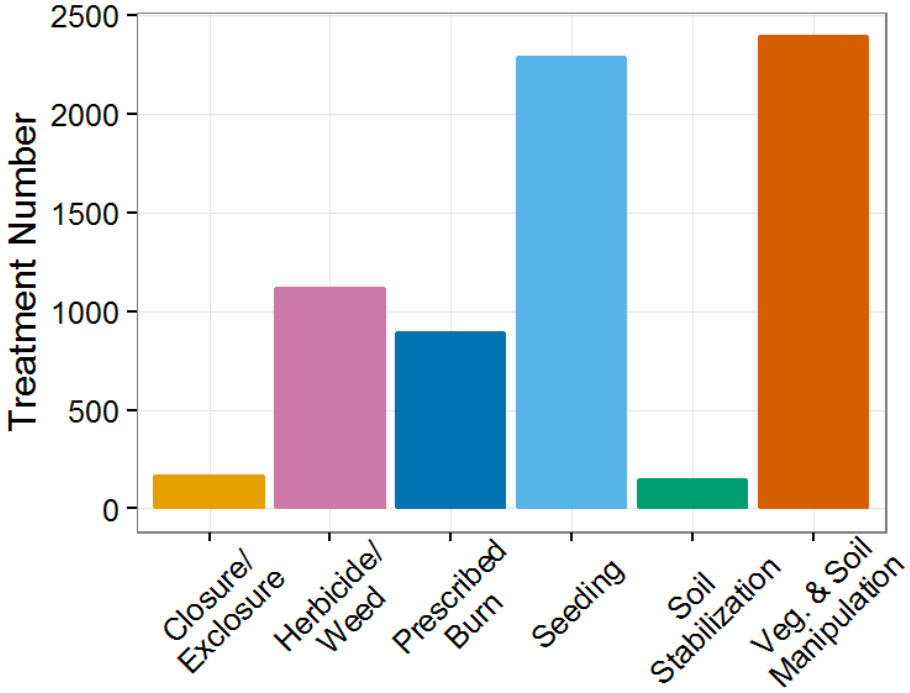
Resource extraction key words

- cattle, cow, forage, fuel, livestock, and timber, excluding cases where livestock exclusion treatments were indicated by the words 'closure' or 'fence'

Treatments decreasing in sagebrush, increasing in annual grassland

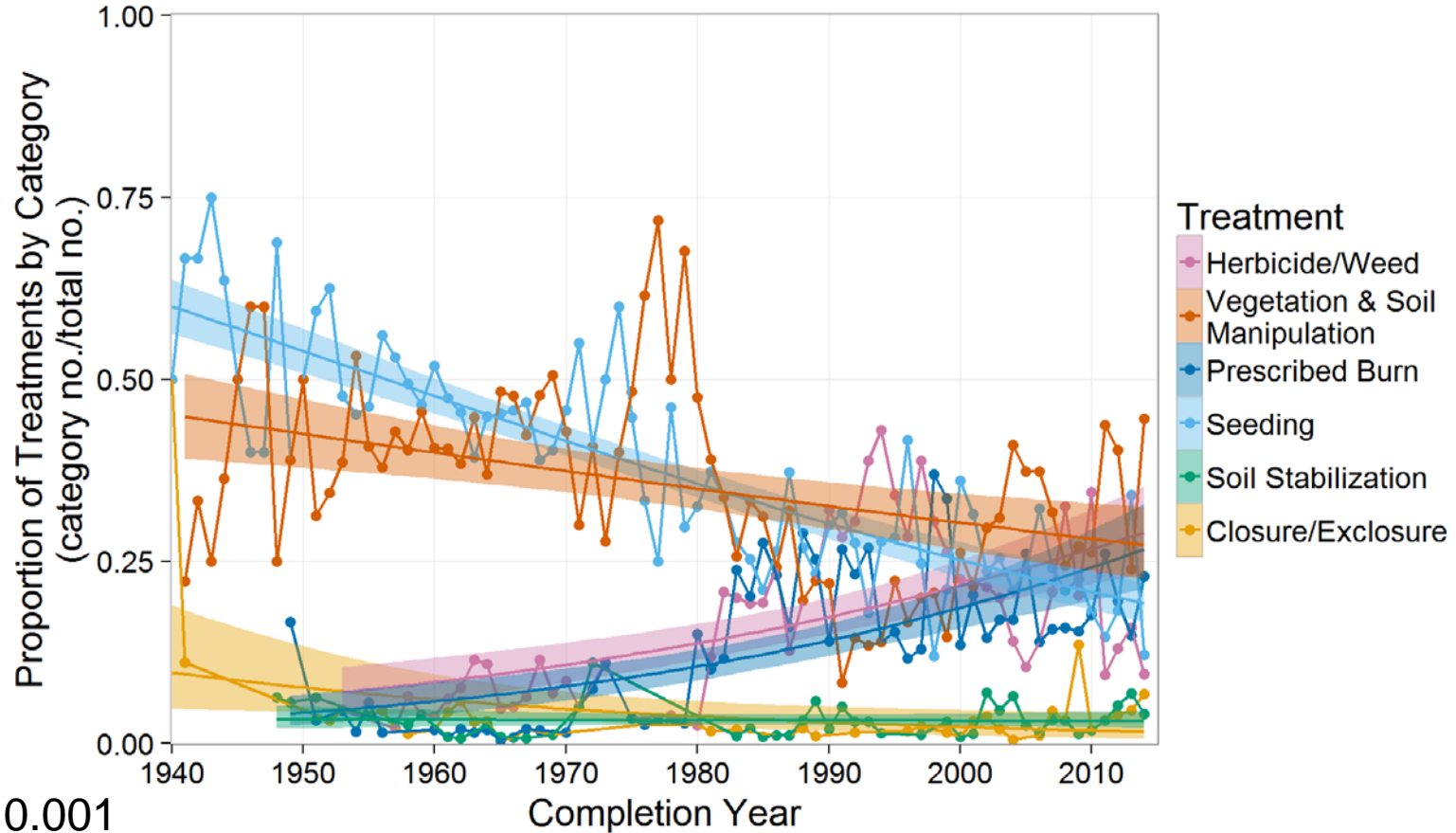


- Dominant veg. types by area: Big Sagebrush, Pinyon-Juniper, Mesquite Woodland, Introduced Annual Grassland, Desert Scrub



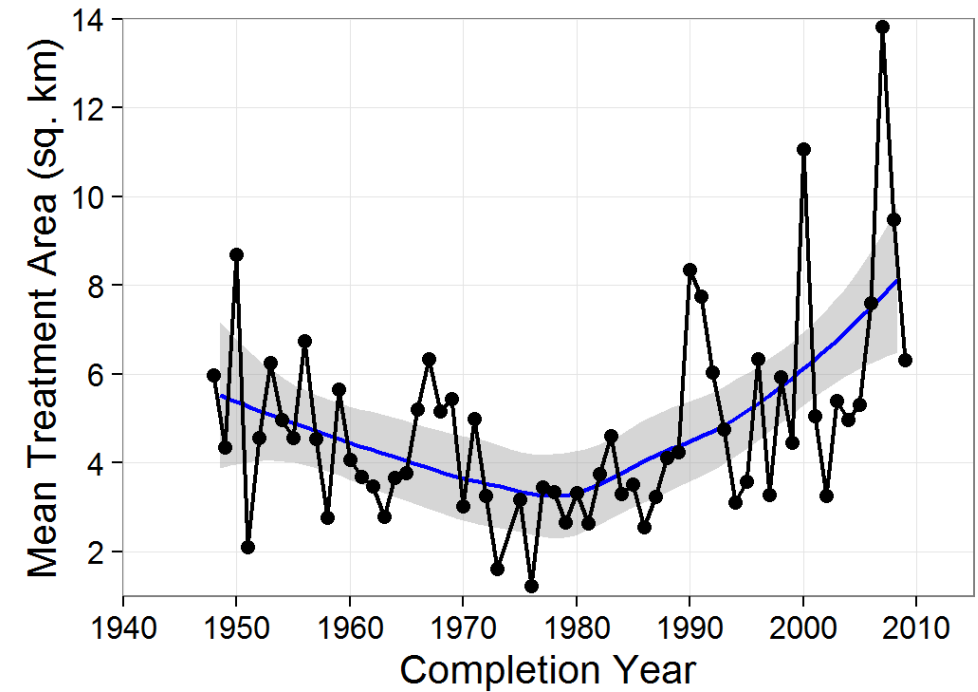
Vegetation & soil manipulation, seeding, and herbicide/weed treatments are most common

The major treatment types have changed over time

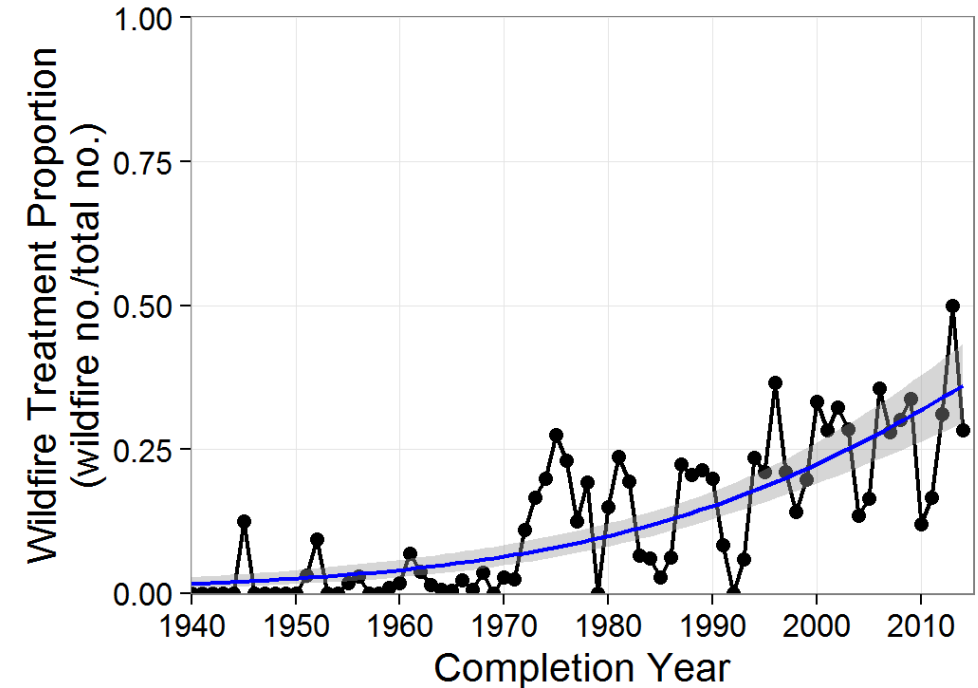


Pseudo-R² = 0.78
 Year x Trt p-value < 0.001

- Total and mean treatment area is increasing



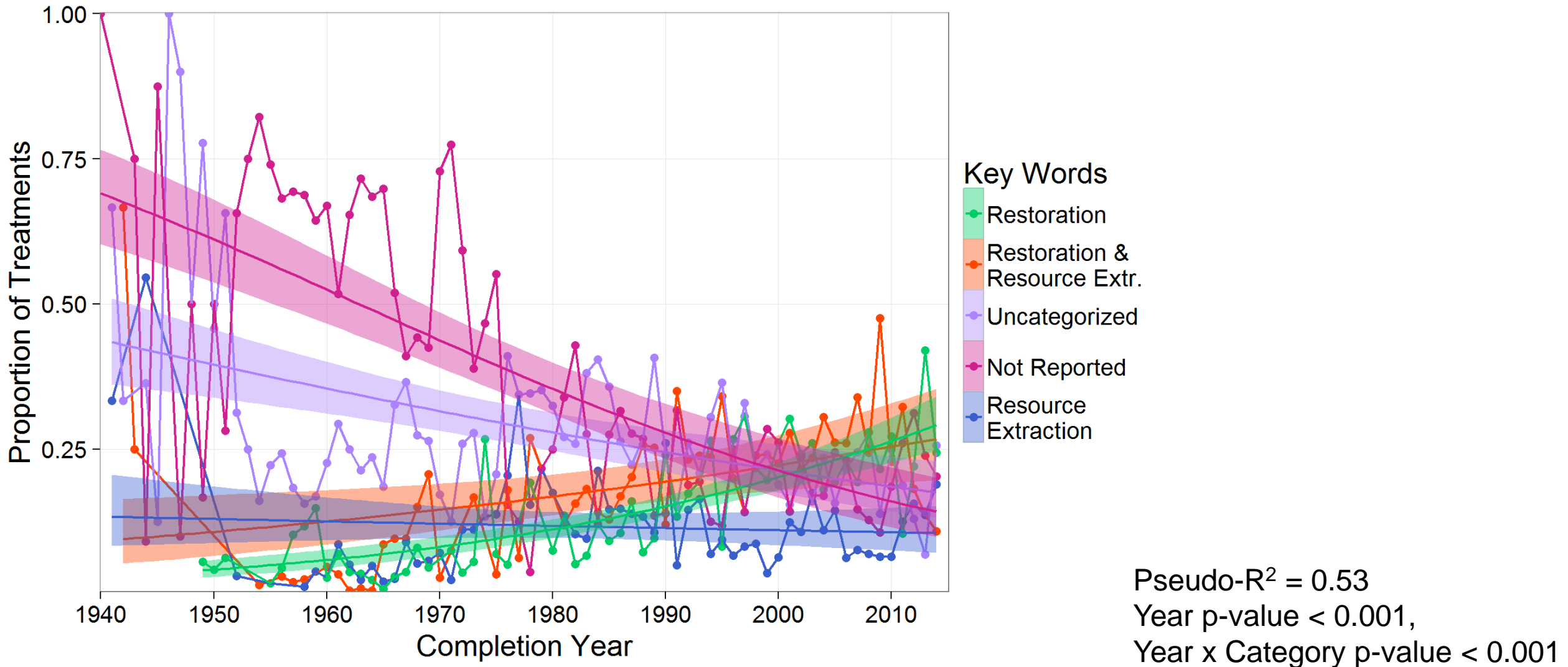
- Increasing fires and fire-related rehabilitation funding may be responsible



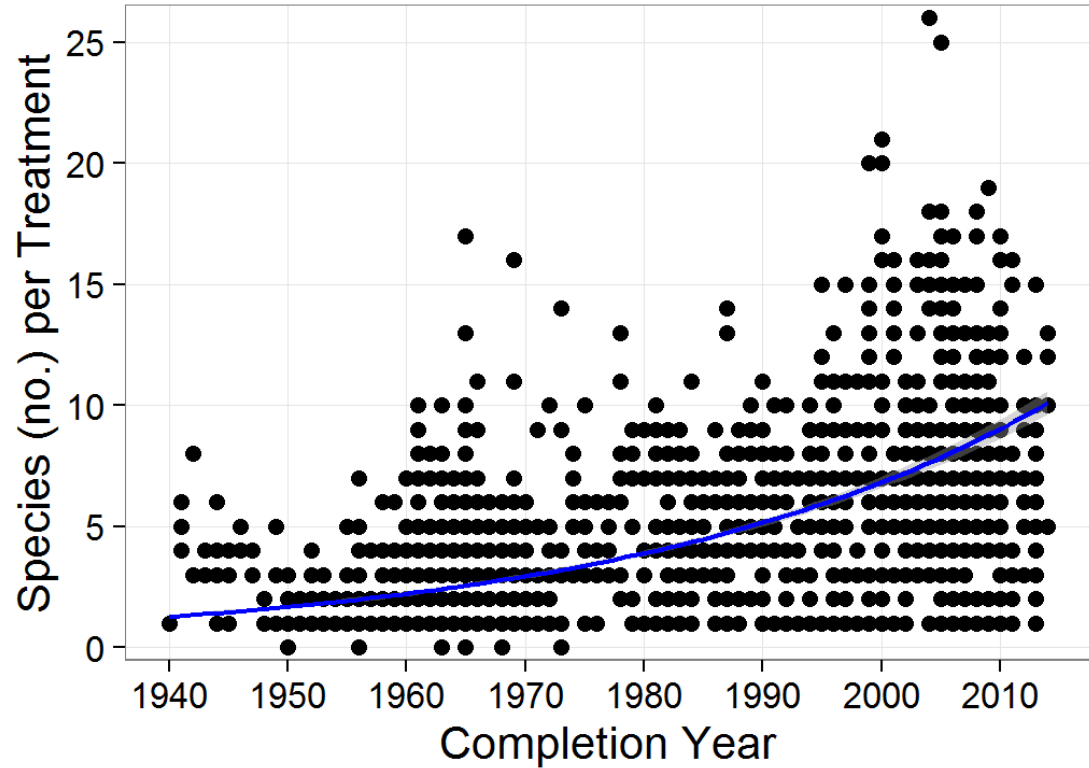
Pseudo-R² = 0.58
Year p-value < 0.001

Are treatment objectives changing over time?

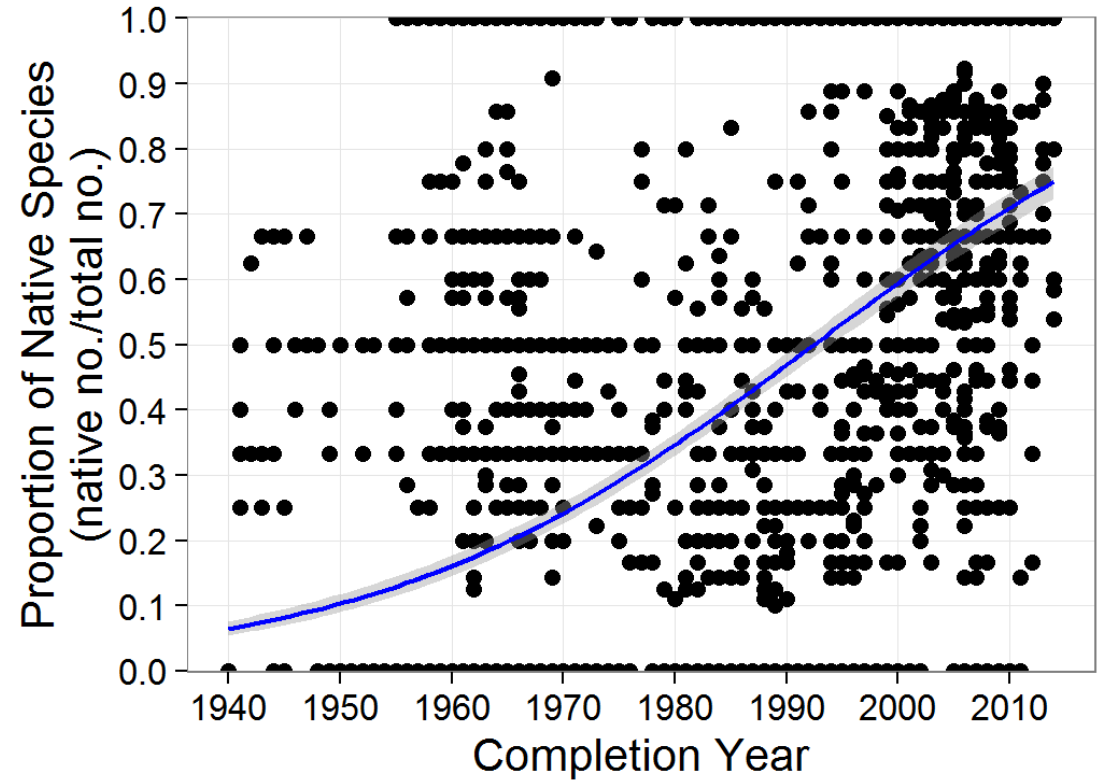
- Restoration and the combination of restoration & extraction key words are increasing



Greater diversity and proportion of native species in seeding



Pseudo- $R^2 = 0.45$, Year p-value < 0.001



Pseudo- $R^2 = 0.27$, Year p-value < 0.001

What are some of the top species in seed mixes?

Top five species in 1945-1954

1 Agropyron desertorum
(non-native)



2 Agropyron cristatum
(non-native)



3 Melilotus officinalis
(non-native)



4 Pascopyrum smithii
(native)



5 Bromus inermis
(non-native)



Top five species in 2005-2014

Photos from SEINET, swbiodiversity.org & Calphotos, calphotos.berkeley.edu

1 Achnatherum
hymenoides (native)



2 Sanguisorba minor
(non-native)



3 Pascopyrum smithii
(native)



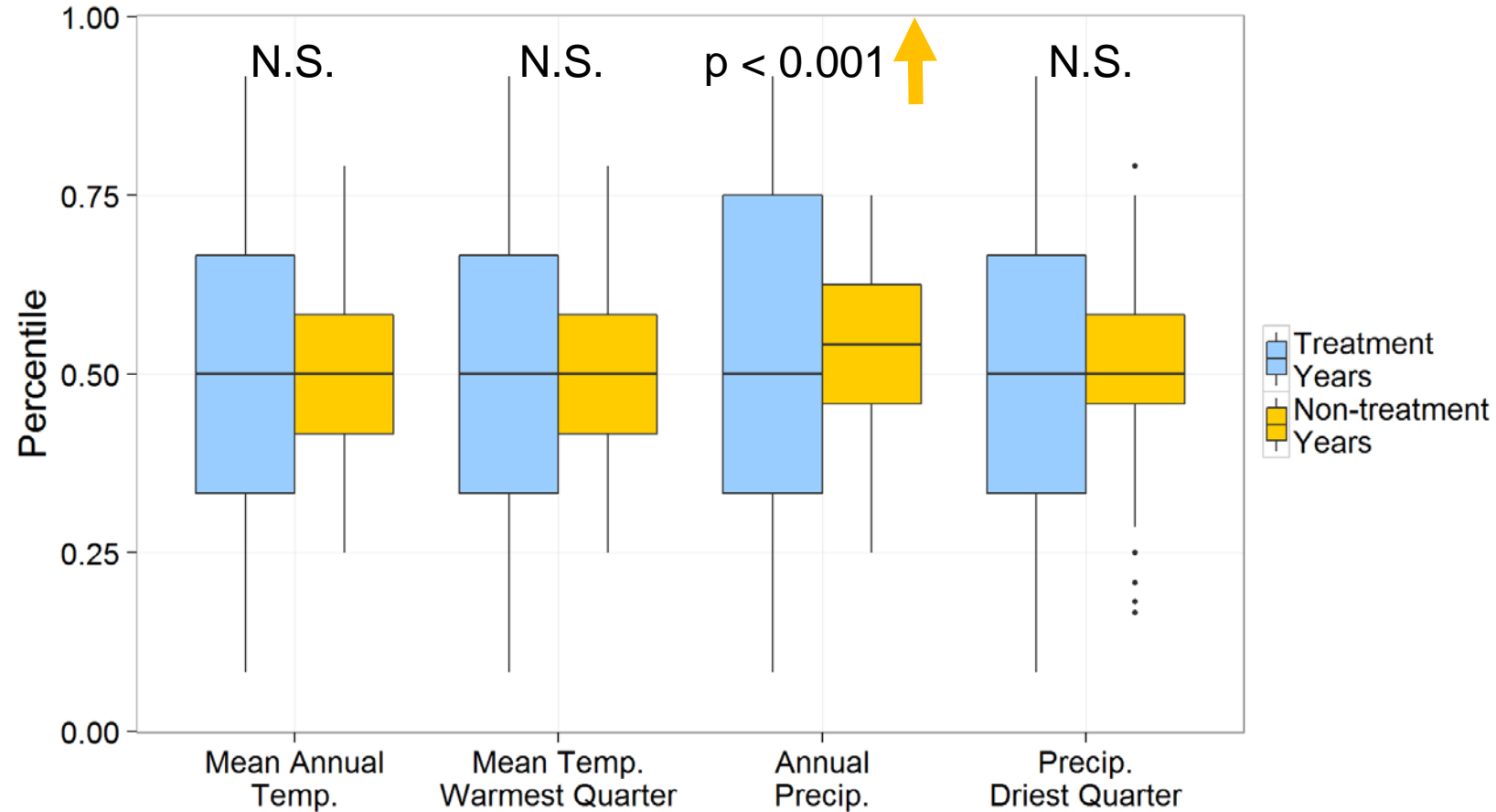
4 Agropyron desertorum
(non-native)



5 Poa secunda
(native)



Are treatments generally applied in favorable climate years?



Mean annual temperature or mean temperature of warmest quarter

- 11 % of treatments, ≥ 90 % percentile

Total precipitation or precipitation of driest quarter

- 2-3 % of treatments, ≤ 10 % percentile

Methods, objectives, and extent of BLM treatments in the Southwest US have changed over time

- Treatment area is increasing
- Invasive species and fire-related treatments are increasing
- Seeding treatments are increasingly diverse, and native-dominated
- Restoration and rehabilitation objectives are more common
- Treatments are not necessarily applied in ideal climate conditions



Implications and future directions

What might be limiting application of successful restoration practices?

- Cost of complex multi-year treatments
- Policy constraints: such as rapid treatment after fire
- Long-term monitoring and detailed documentation are rare!
- Conflicting management goals: resource extraction to conservation
- Availability of appropriate seed materials
- Medium-term climate predictions (2-3 years)



Acknowledgements

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Land Treatment Digital Library <http://ltdl.wr.usgs.gov/>: David Pilliod & Justin Welty & the many others who have worked on this project





Questions? Comments?
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RAMPS is planning on hiring a Restoration Coordinator!
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