

Insights Gained through Monitoring Multiple Years of Post-fire Treatments

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The Problem with Desert Wildfires

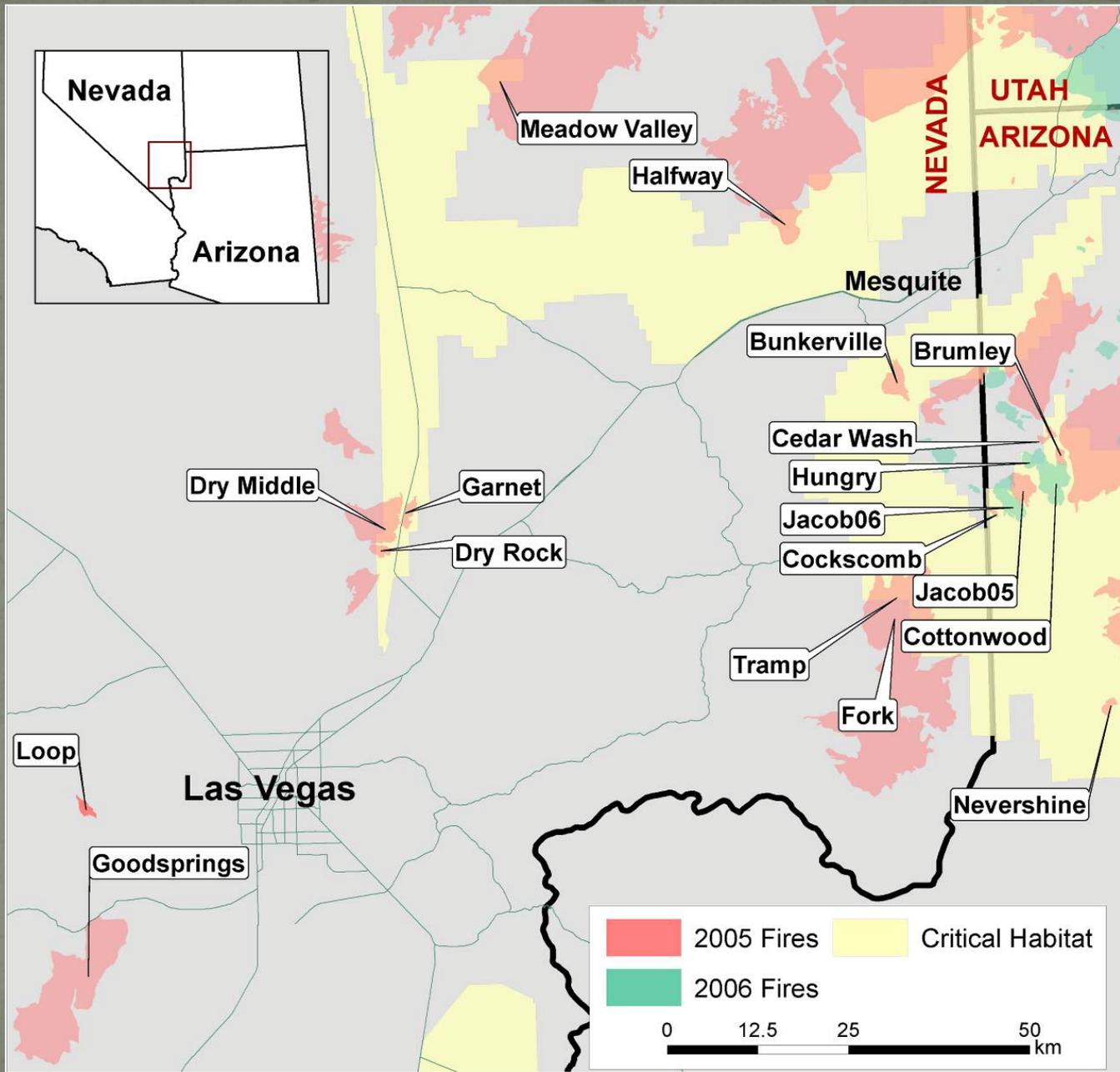
- Fires have increased in frequency and size (Brooks & Matchett 2006)
- Native shrub resprouting is limited (DeFalco et al. 2010)
- Fires are altering habitats for sensitive species such as desert tortoise (Esque et al. 2003)
- Little is known about rehabilitating burned desert shrublands (Abella and Newton 2009)



Challenges of Rehabilitating Burned Habitats

- Scarce plant materials available for large landscape disturbances
- Insufficient knowledge about which methods work, when they work and where they work
- Variable revegetation success among limited number of studies

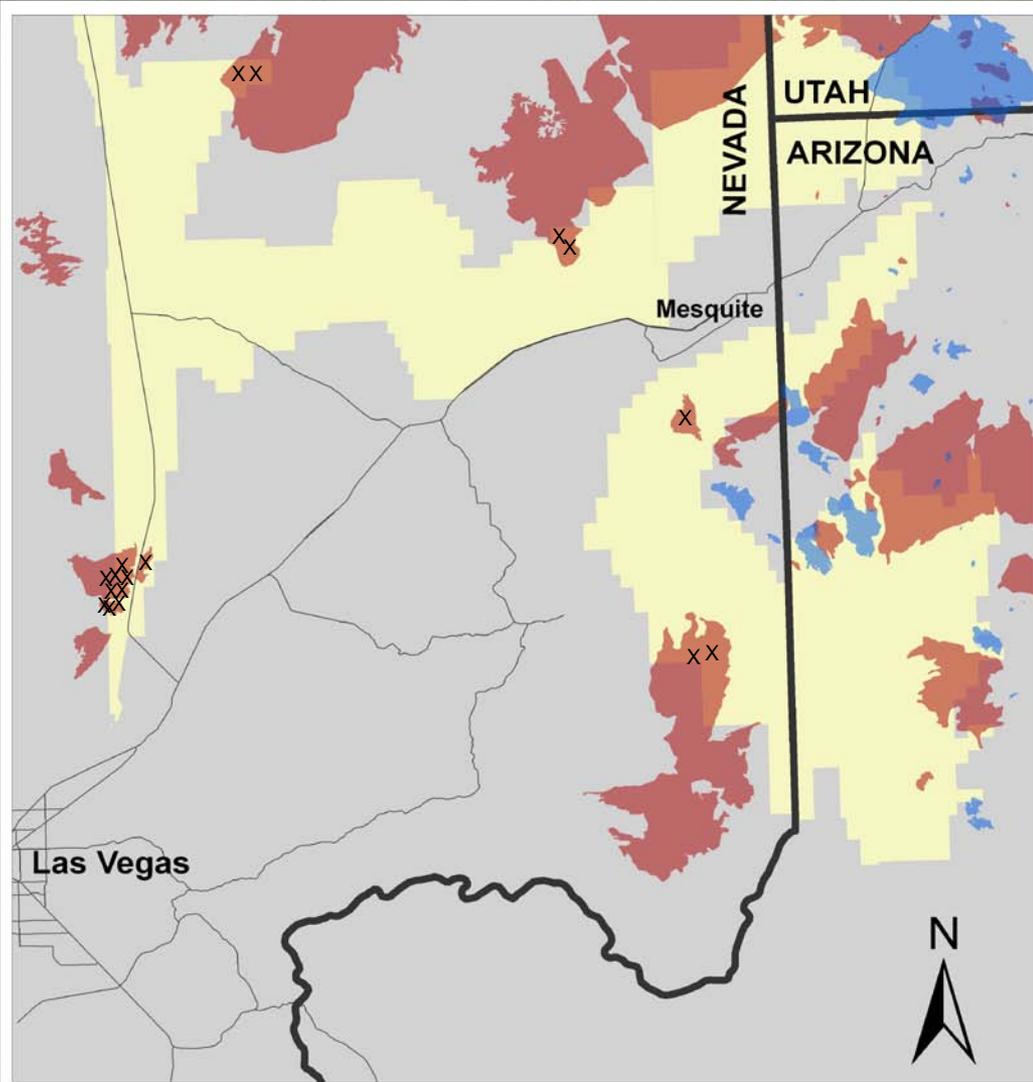
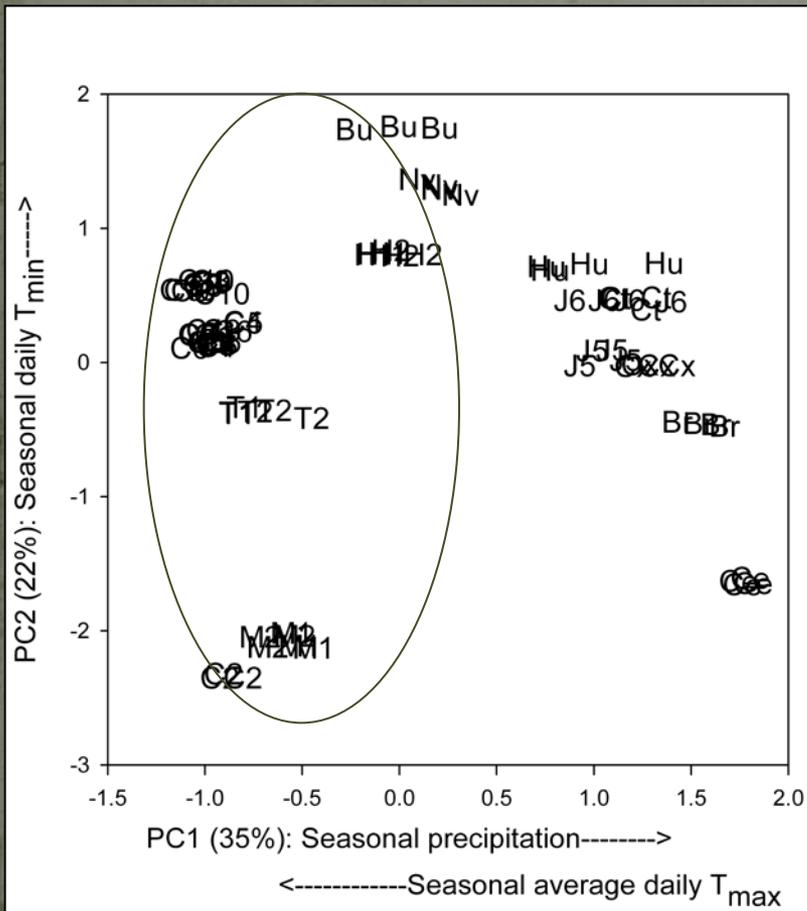




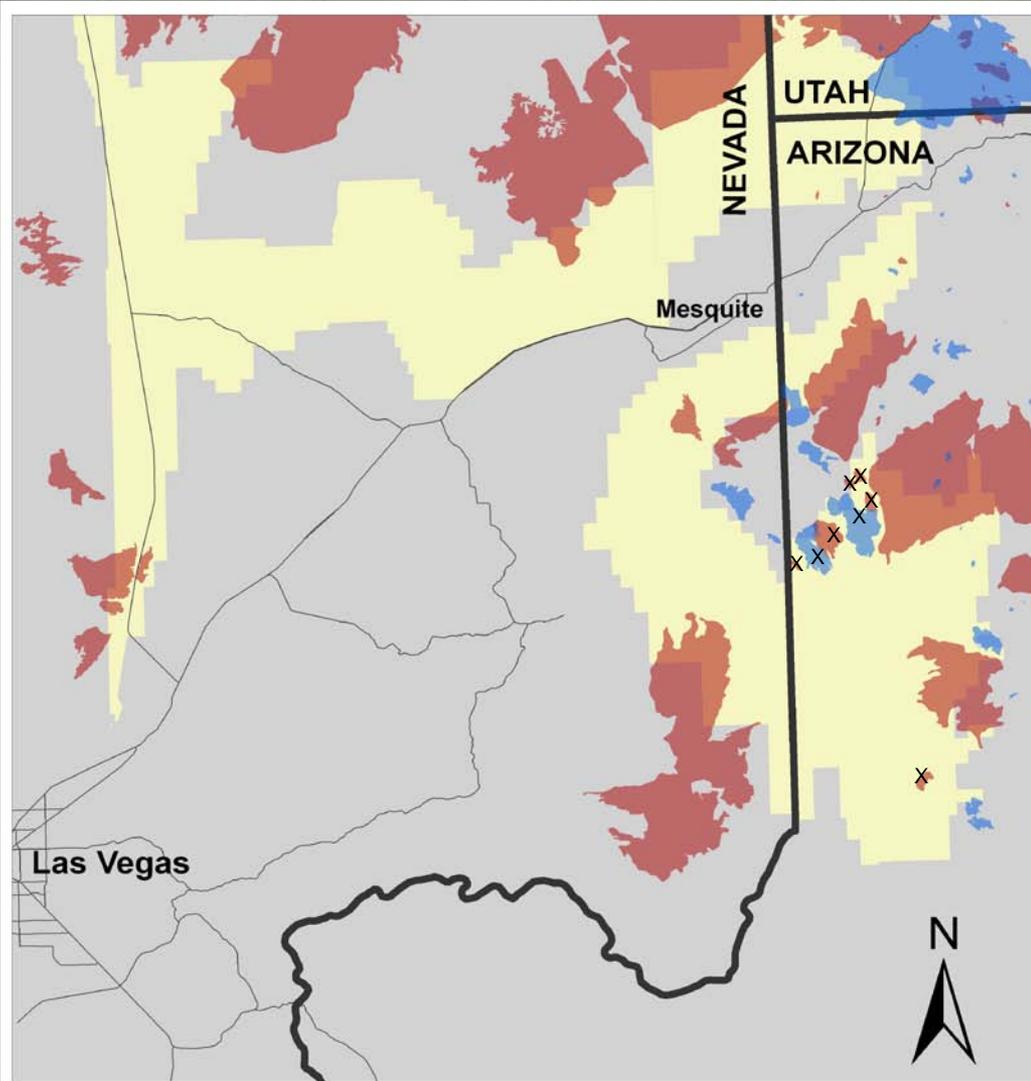
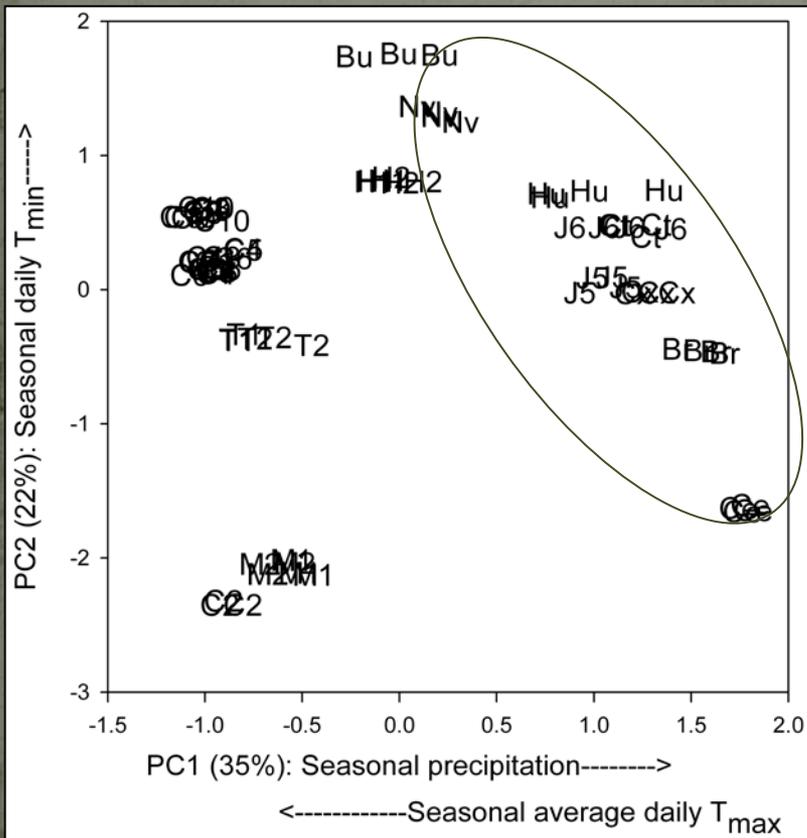
Multiple Years of Treatment Monitoring Following the 2005/2006 Wildfires

- BLM applied post-fire treatments in southern NV and northwestern AZ in desert tortoise habitat (creosote bush-bursage and blackbrush shrublands)
- USGS monitoring for success of native plants and control of non-native plants on large treated and untreated plots (2006-2011)
- Emerging lessons for post-fire rehabilitation into the future

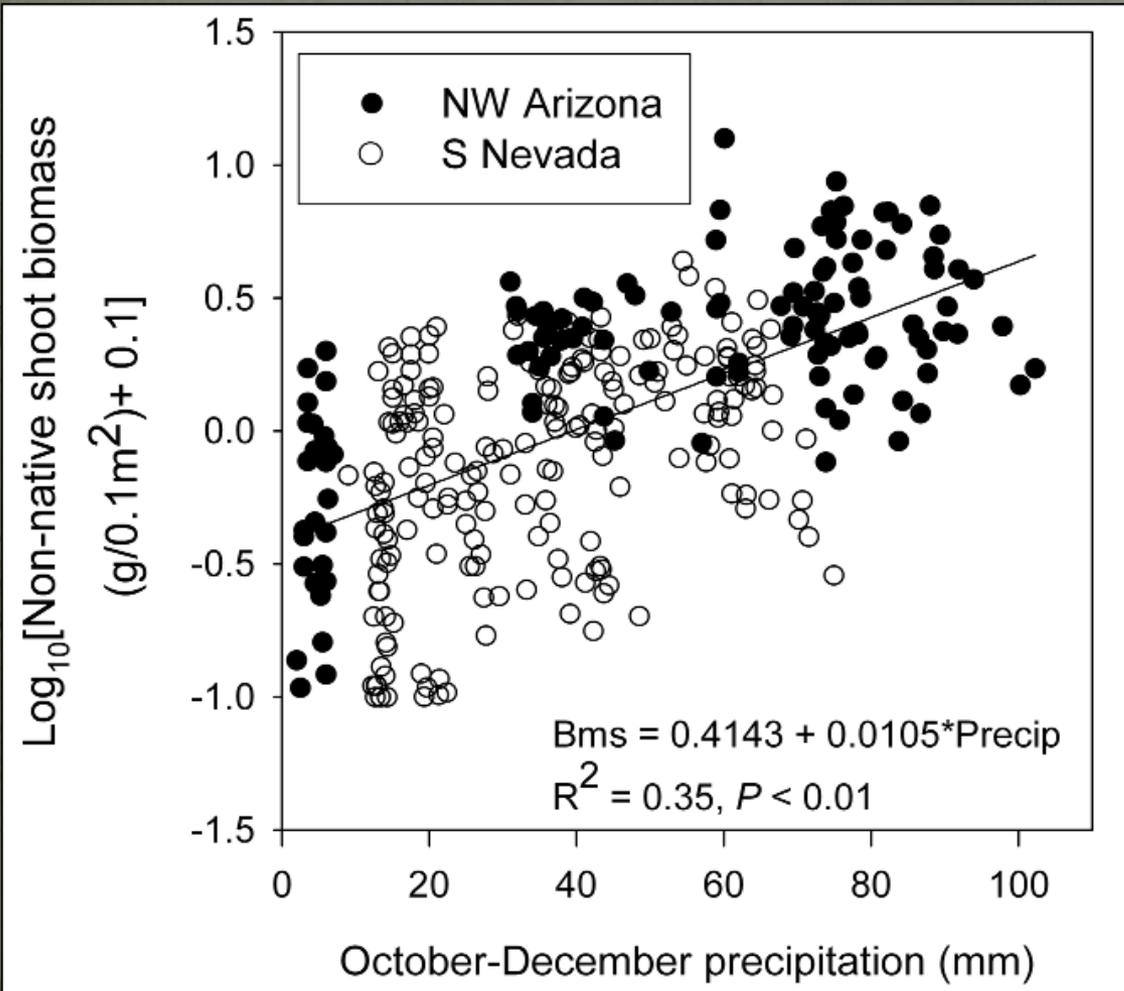
Southern NV (N=17 sites)



Northwestern AZ (N=8 sites)



Winter Precipitation and Non-natives

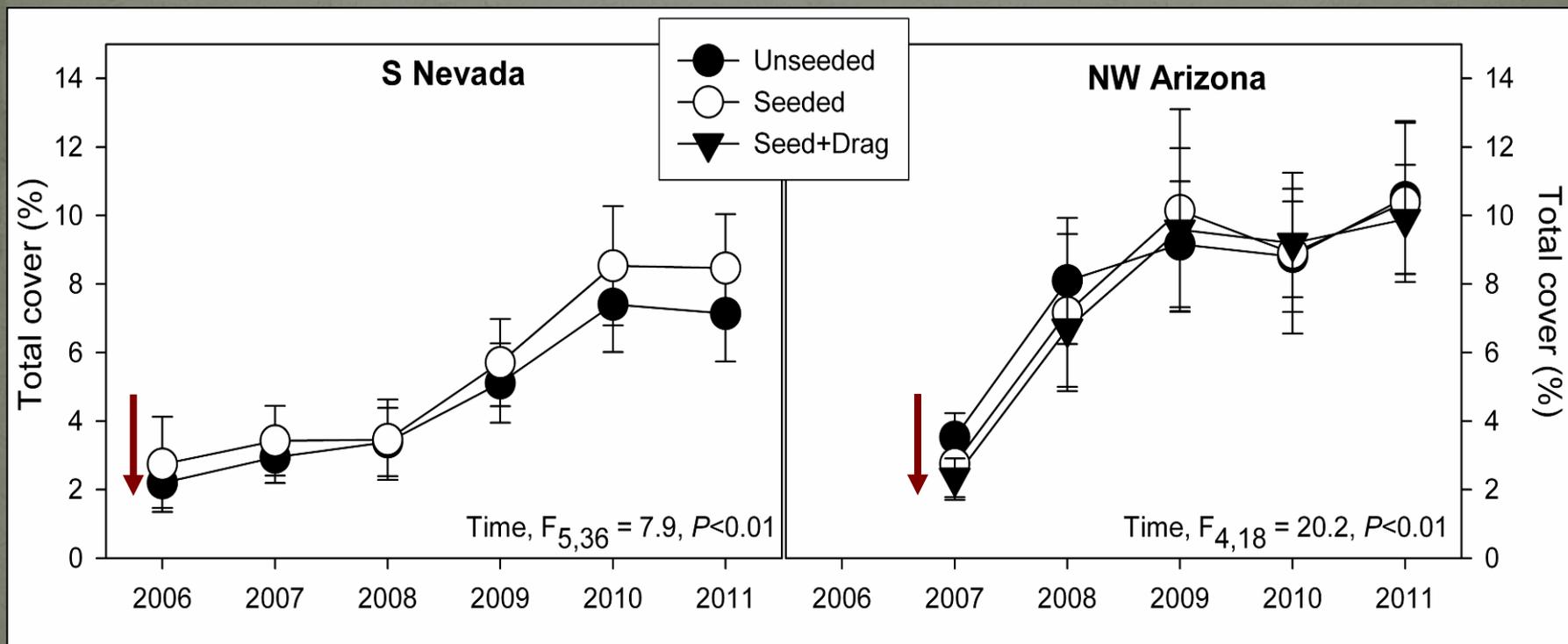


S Nevada and NW Arizona Sites

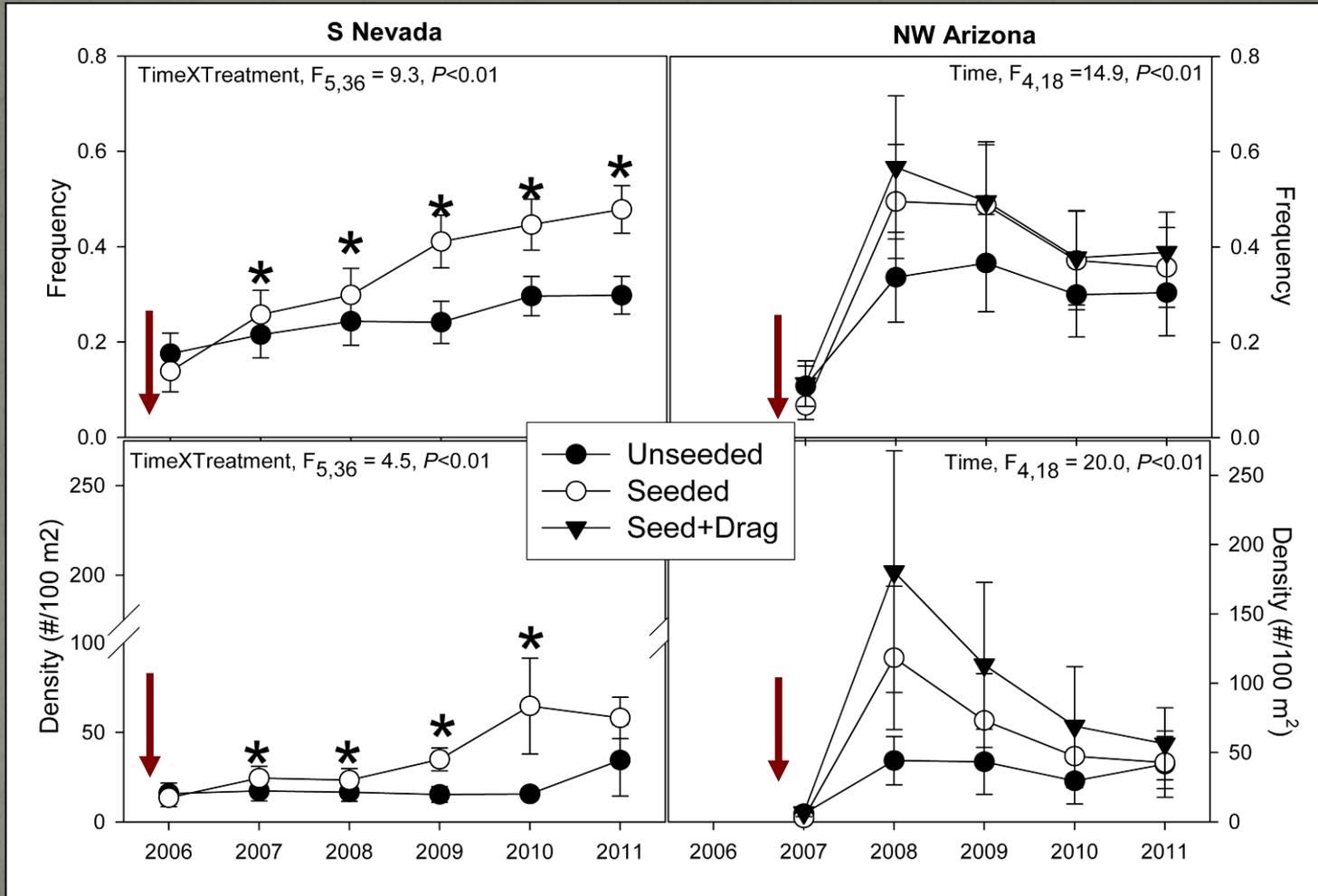
- Seed mixes (Shrub vs. perennial grass)
- Fire history (Single vs. multiple fires)
- Treatment methods (Hand- vs. aerial-seeding/seed incorporation)
- Six vs. five years of monitoring



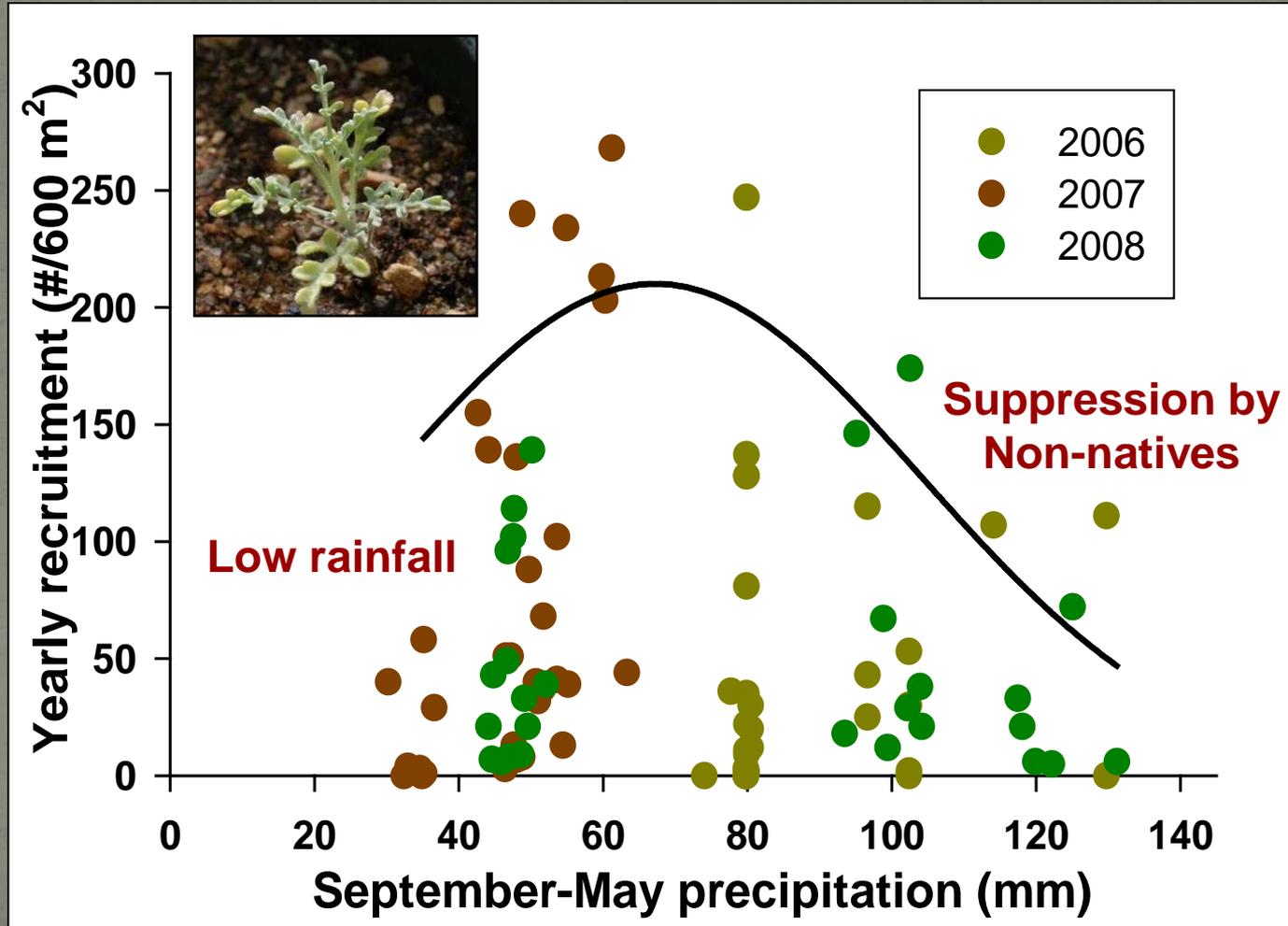
Short-term Recovery of Perennial Canopy Cover



Establishment of Seeded Perennials



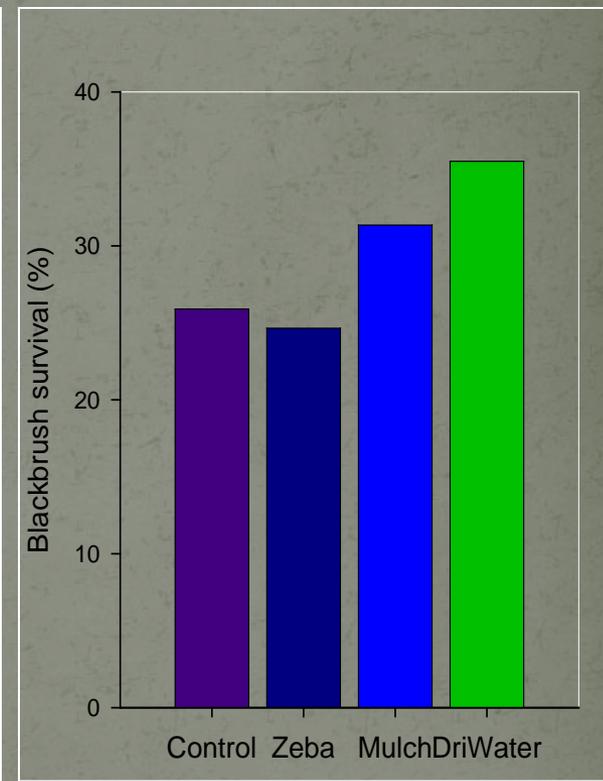
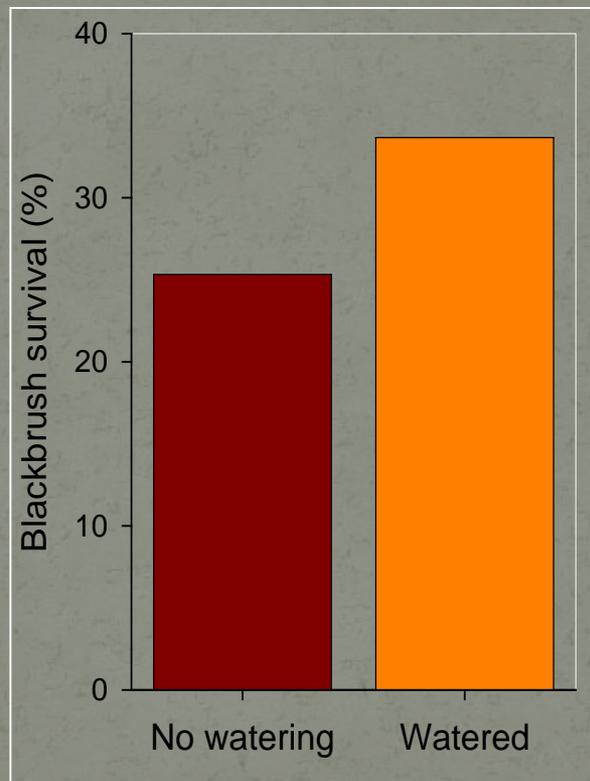
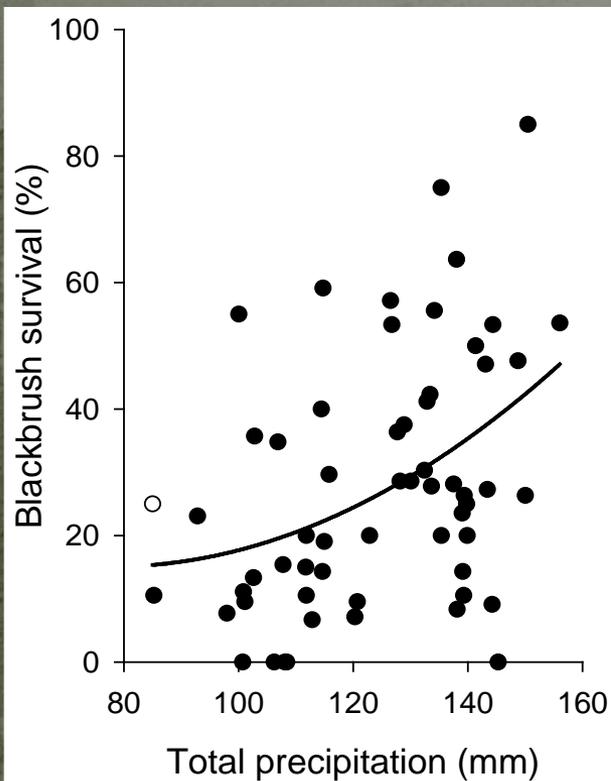
Potential Limitations to Perennial Plant Establishment



Outplanting of Seedlings With Soil Moisture Manipulations: S Nevada

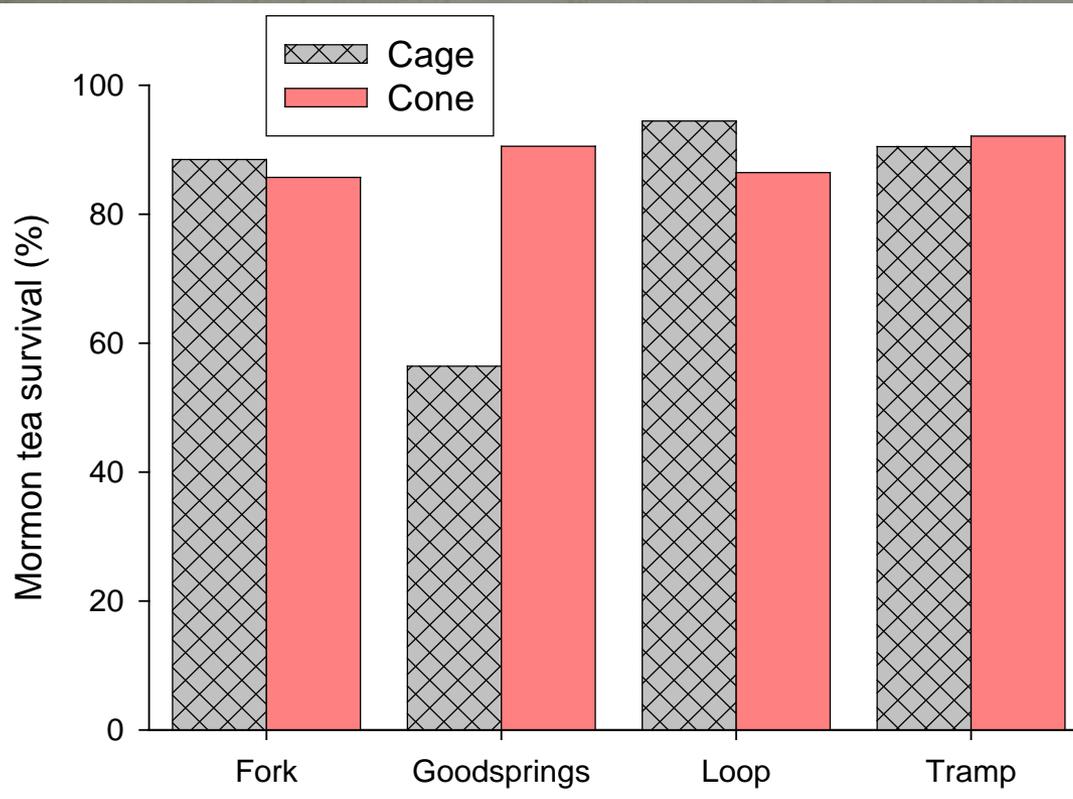


Blackbrush Seedling Survival

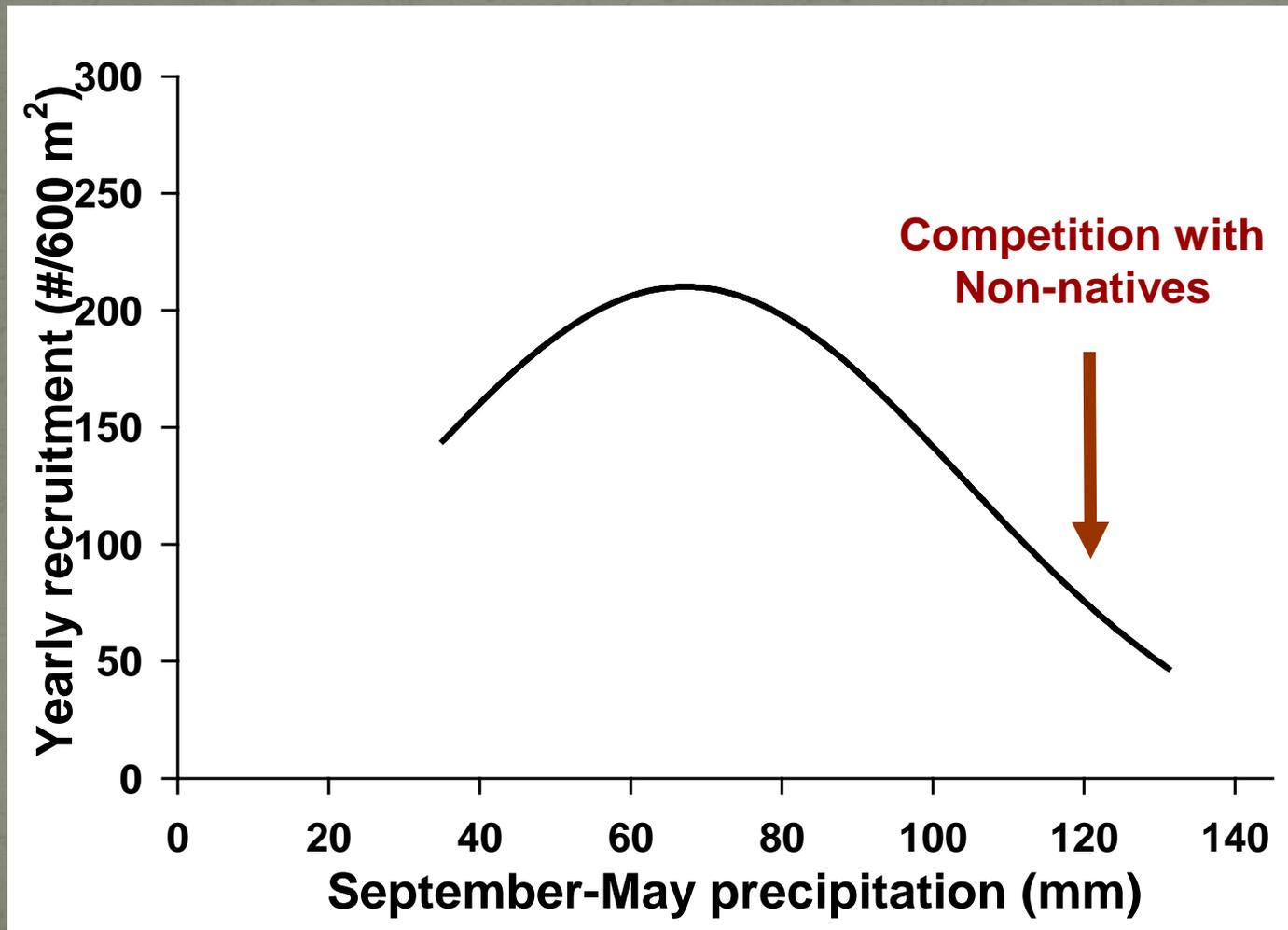


**“Blackbrush response to surface soil moisture”
(Lin *et al.* 1997; Gebauer & Ehleringer 2000)**

Mormon Tea Seedling Survival



Potential Limitations to Plant Establishment



Herbicide Application in Desert Tortoise Habitat

- Pre-emergent (Plateau, Oust) & post-emergent (Journey, RoundUp) applied in Oct 2008 and Feb 2009
- Application to total plot area (pre-emergent) or targeted to brome grass production (post-emergent)
- 3.5 oz/acre
- Seeding before herbicide application

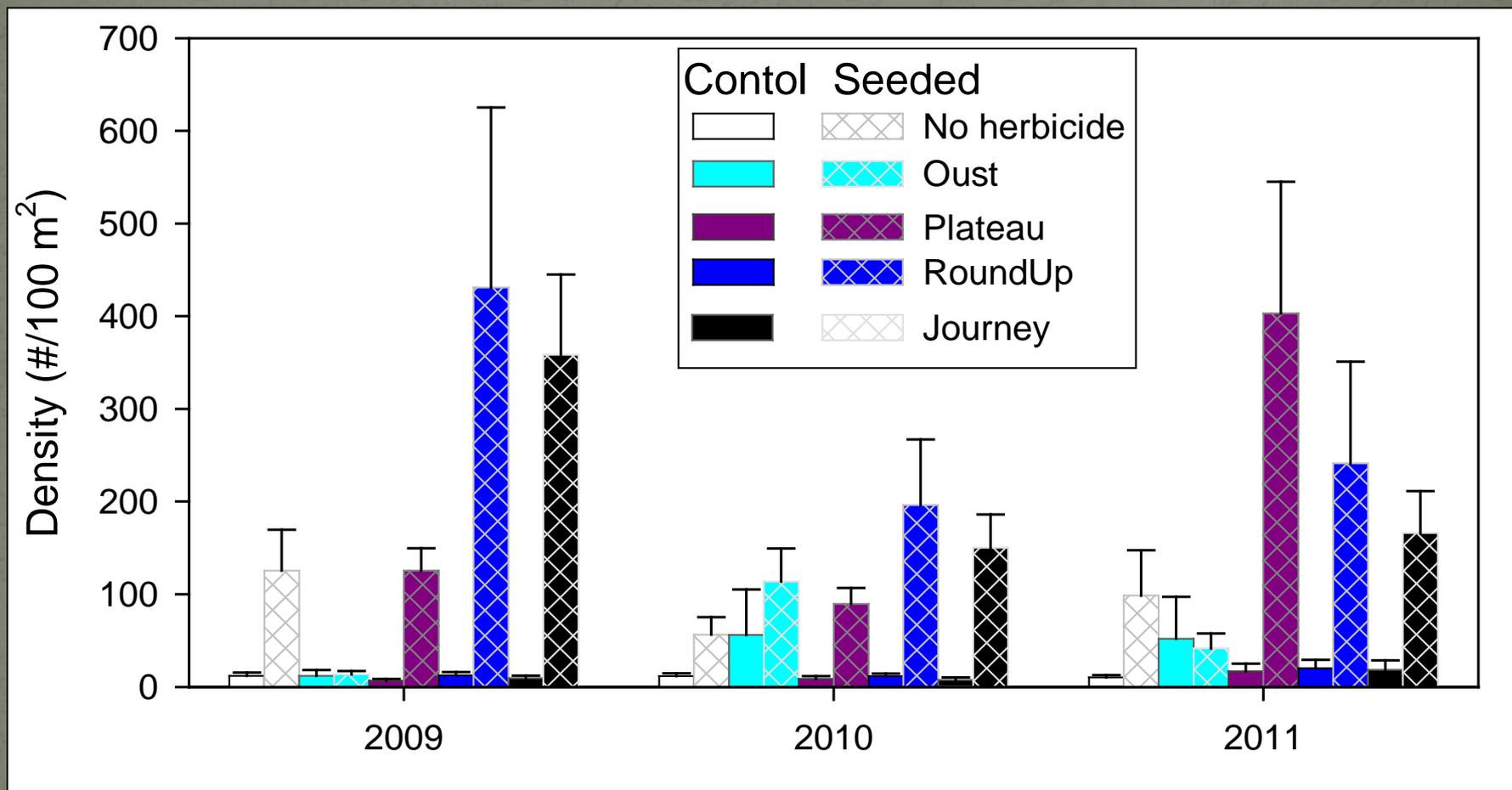


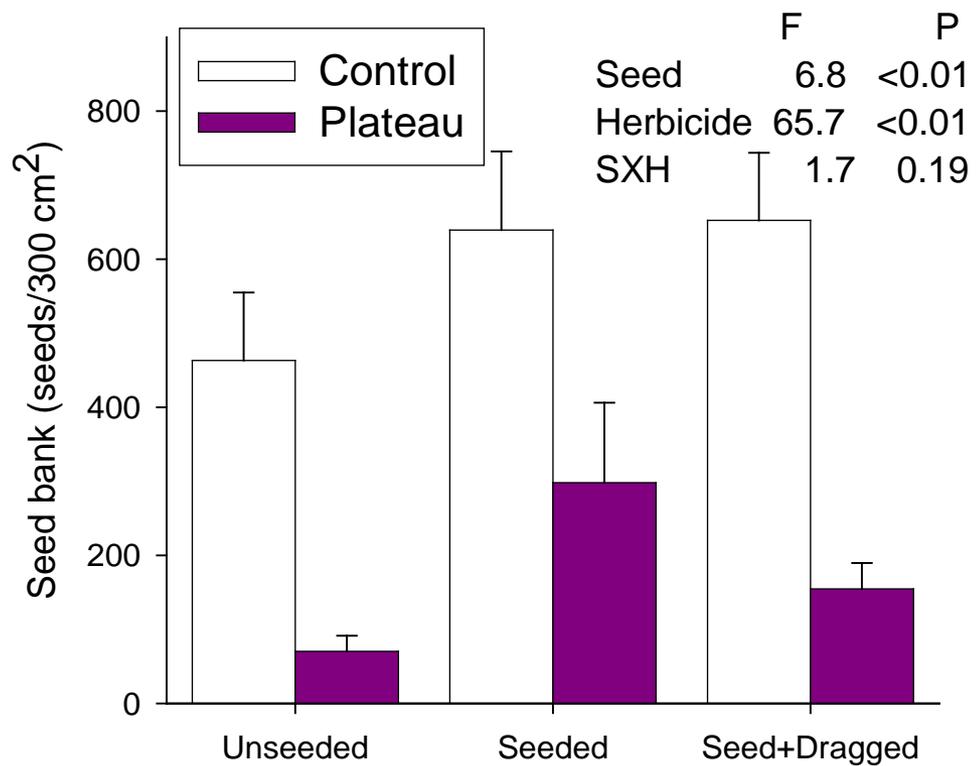
Reduction of Non-Native Biomass



		2009	2010
S Nevada:	Plateau	-85%	-44%
	Oust	-75%	-14%
	Journey	-29%	-48%
	RoundUp	-19%	+3%
NW Arizona:	Plateau	-83%	-44%

Herbicides Enhance Seeding





Lessons Learned . . .

- Our visual perception of rehabilitation success and quantitative metrics often do not agree
- Seeding is showing promise across multiple sites and is enhanced in combination with herbicide application
- At sites where rainfall is consistently low, outplanting of early-colonizing species in combination with watering supplementation may be a better alternative than seeding
- Long-term monitoring continues to provide insights into the alternatives for revegetating burned desert lands

What Do Trends Mean For Tortoises?



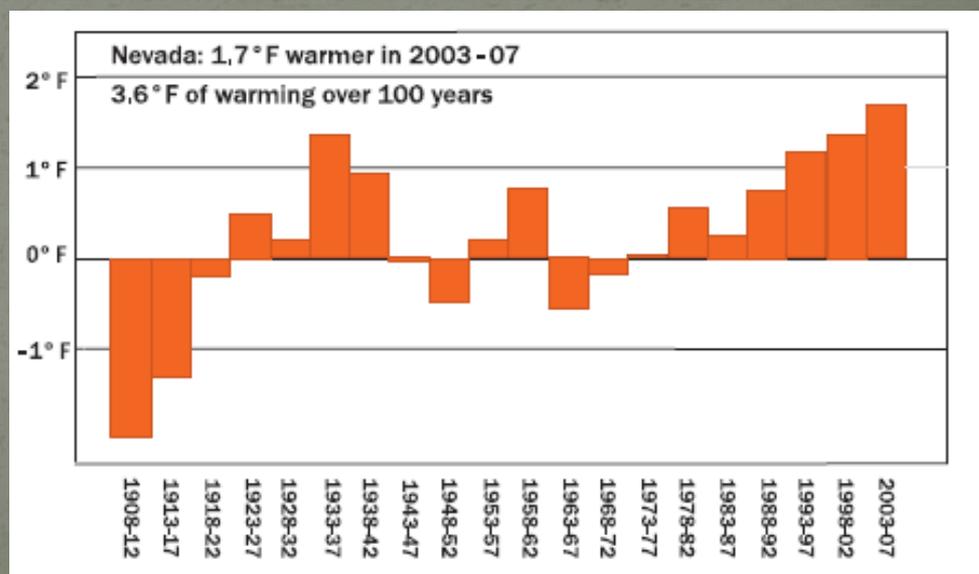
A Complex Future for Post-Fire Rehabilitation

More Rapid Warming in the West

2003 to 2007 5-Year Average Temperatures Compared to 20th Century Averages

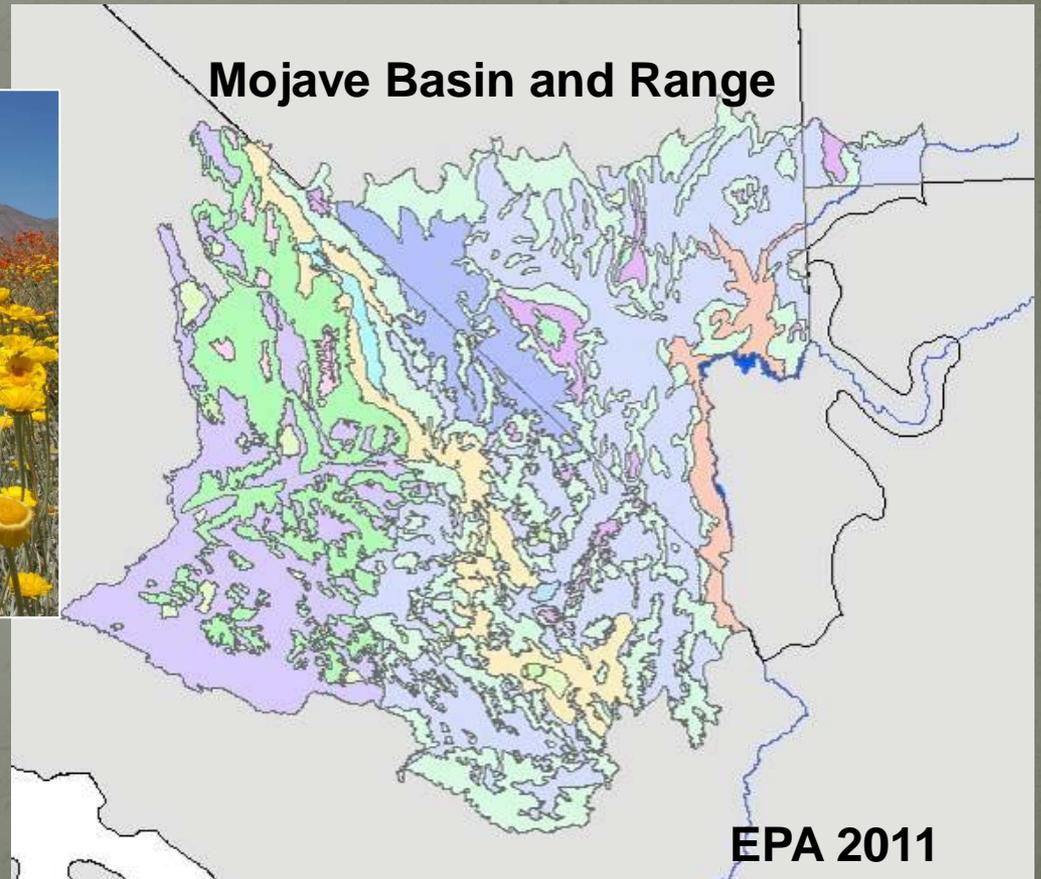
Planet	+1.0°F
Western United States	+1.7°F
Colorado River Basin	+2.2°F
Arizona	+2.2°F
California	+1.1°F
Colorado	+1.9°F
Idaho	+1.8°F
Montana	+2.1°F
Nevada	+1.7°F
New Mexico	+1.3°F
Oregon	+1.4°F
Utah	+2.1°F
Washington	+1.4°F
Wyoming	+2.0°F

- During the past 5 years, 11 western states have averaged 1.7°F warmer than the 20th century average
- More intense and longer duration of droughts
- Increases in fire frequency



Saunders *et al* 2008

Where Will Future Sources of Plant Material Come From? Mojave Desert Seed Transfer Zones



EPA 2011

- Bureau of Land Management, Las Vegas
- Bureau of Land Management, Ely
- Bureau of Land Management, Arizona Strip
- Clark County Desert Conservation Program
- Lake Mead NRA
- College of Southern Nevada
- Student Conservation Association
- Nevada Conservation Corps
- USGS



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Invasive Species, Priority Ecosys Studies Programs