Desert Restoration: Status of Knowledge and Future Directions

Scott R. Abella
Associate Research Professor
University of Nevada Las Vegas
scott.abella@unlv.edu
http://faculty.unlv.edu/abellas2/

Department of Environmental and Occupational Health

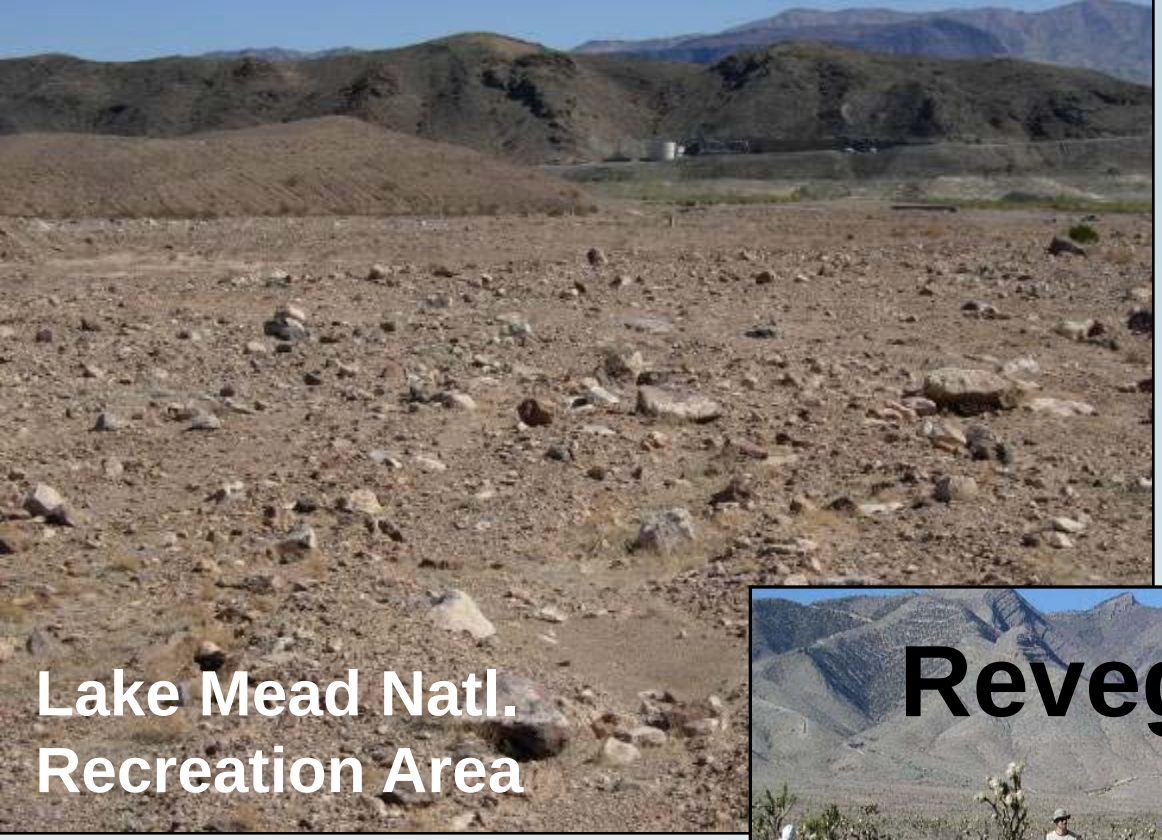
UNLV

UNIVERSITY OF NEVADA LAS VEGAS

Outplanting on a s. NV burn

07/13/2011

Many disturbance types



Lake Mead Natl. Recreation Area

Reveg is expensive

Wildfire, SE of Vegas, BLM

Int. J. Environ. Res. Public Health **2010**, *7*, 1248-1284; doi:10.3390/ijerph7041248

OPEN ACCESS

International Journal of
Environmental Research and
Public Health
ISSN 1660-4601
www.mdpi.com/journal/ijerph

Recovery from disturbance

Review

Disturbance and Plant Succession in the Mojave and Sonoran Deserts of the American Southwest

Scott R. Abella

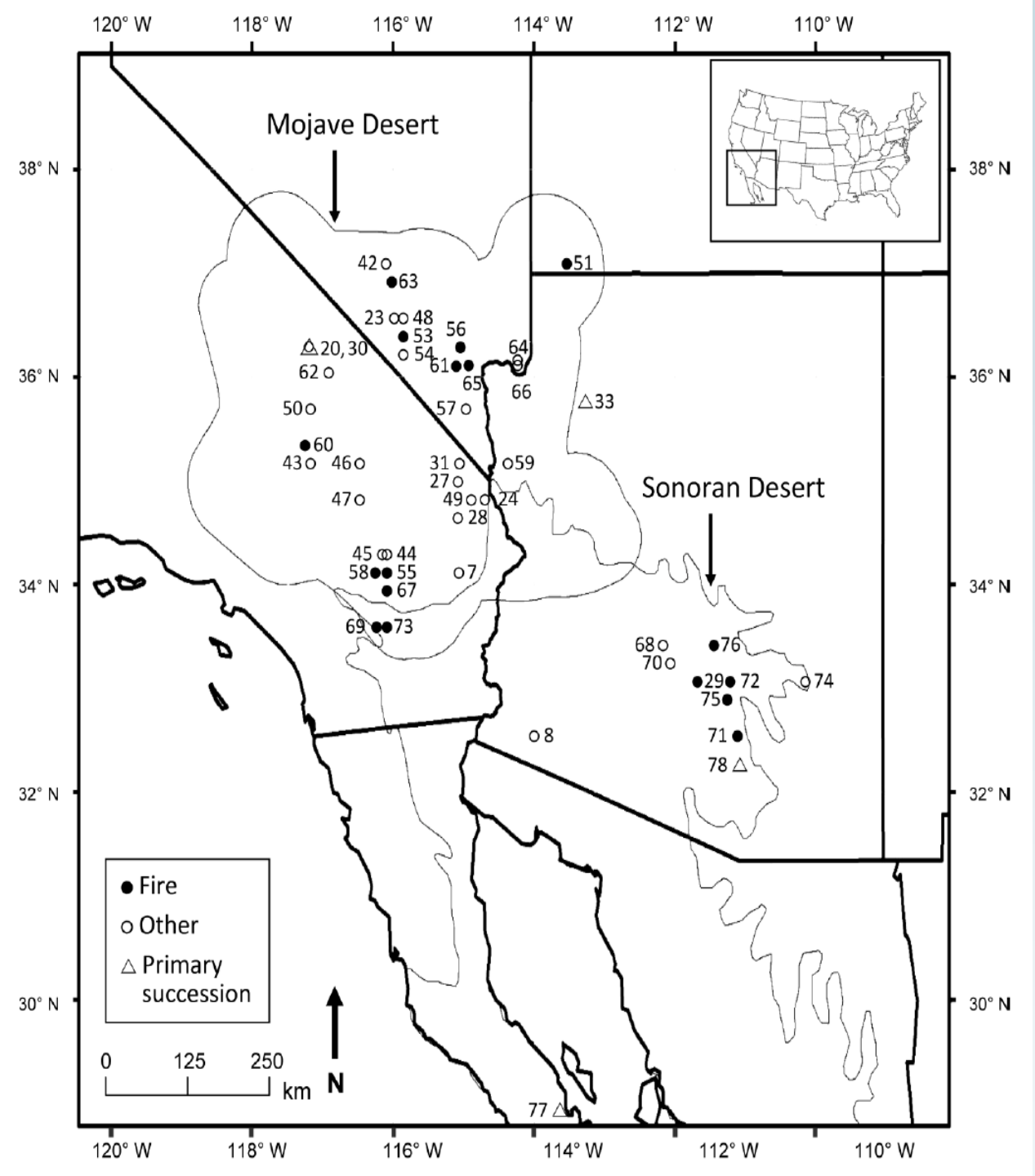
School of Environmental and Public Affairs, University of Nevada Las Vegas, Las Vegas, NV 89154-4030, USA; E-Mail: scott.abella@unlv.edu; Tel.: +1-702-895-5163; Fax: +1-702-895-4436

Received: 22 December 2009; in revised form: 23 March 2010 / Accepted: 24 March 2010 / Published: 25 March 2010

Abstract: Disturbances such as fire, land clearing, and road building remove vegetation and can have major influences on public health through effects on air quality, aesthetics, recreational opportunities, natural resource availability, and economics. Plant recovery and succession following disturbance are poorly understood in arid lands relative to more temperate regions. This study quantitatively reviewed vegetation reestablishment following a variety of disturbances in the Mojave and Sonoran Deserts of southwestern North America. A total of 47 studies met inclusion criteria for the review. The time estimated by 29 individual studies for full reestablishment of total perennial plant cover was 76 years. Although long, this time was shorter than an estimated 215 years (among 31 individual studies) required for the recovery of species composition typical of undisturbed areas, assuming that recovery remains linear following the longest time since disturbance measurement made by the studies.

Keywords: arid land; recovery; revegetation; fire; management; resource damage; dust mitigation; diversity

Tramp Fire,
Gold Butte, NV



47 studies

Years to recovery

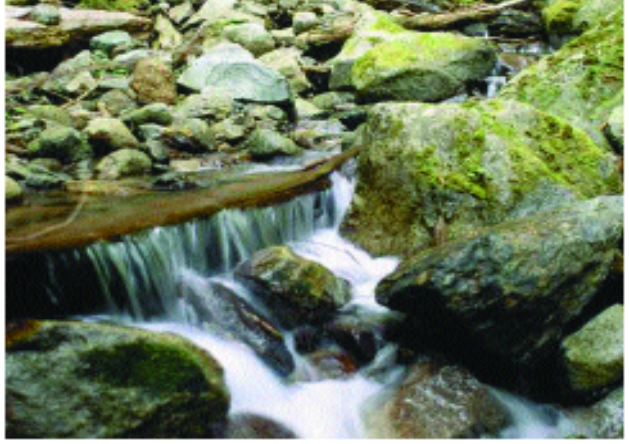
Cover: 76

Richness: 38

Composition: 215

Annuals: shorter

Pipeline water intake area of Las Vegas, W of Lake Mead. Age 38 yrs



“The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.” It is an intentional activity that initiates or accelerates the recovery of an ecosystem.

The SER International Primer on Ecological Restoration

Society for Ecological Restoration International
Science & Policy Working Group (Version 2: October, 2004)*

Meeting functional objectives, and by-product benefits

Reprinted from the *Journal of Environmental Quality*
Volume 27, no. 5, Sept.–Oct. 1998, Copyright © 1998, ASA, CSSA, SSSA
677 South Segoe Rd., Madison, WI 53711 USA

Seeding Native Plants to Restore Desert Farmland and Mitigate Fugitive Dust and PM_{10}

David A. Grantz,* David L. Vaughn, Rob Farber, Bong Kim, Mel Zeldin, Tony VanCuren, and Rich Campbell

ABSTRACT

Windblown fugitive dust contributes to violations of air quality standards for particulate matter <10 μm aerodynamic diameter (PM_{10}). In the western Mojave Desert of California, approximately 1070 ha of previously tilled or over-grazed land impacted downwind metropolitan areas by wind-driven emissions of dust. A protocol of furrowing across the wind and direct seeding of three native perennial shrubs and a bunch grass helped reduce fugitive dust emissions in this area by more than 95%. Seeded species varied from 35 to 97% of living plant cover in individual years, reflecting rainfall patterns. In areas of deep sand, Indian ricegrass (*Achnatherum hymenoides* Roemer & Shultes) outperformed the shrubs, while fourwing saltbush [*Atriplex canescens* (Pursh) Nutt.] exhibited the most widespread establishment. This revegetation was achieved in an anomalous year with above average and late rainfall that eliminated early competition from annual species and later fostered abundant shrub growth. This success was not reproducible in more normal years, when minimal disturbance protocols such as broadcasting of seed on the untilled soil surface were as effective and less costly. We conclude: (i) direct

TABLE 2. Control of fugitive dust at 3.3 feet above the ground by directly seeded vegetation in the Emergency Watershed Protection Program for periods with wind gusts above 34 mph

Dust collected		Control
Barren area	EWP area	
g		%
75.1*	0.380	99.5
0.47†	0.013	91.0

*Drought conditions, 1992. Control area in western Antelope Valley.
†Wet conditions, 1994–1996 average. Control area in mid-Antelope Valley.

Goal and Outline

To illustrate some key principles of desert restoration and future advances

- **Revegetation (planting and seeding)**
- **Soil restoration**
- **Restoring structure**
- **Constraining exotics**
- **Future advances**

A Systematic Review of Species Performance and Treatment Effectiveness for Revegetation in the Mojave Desert, USA

Scott R. Abella[*1] *and Alice C. Newton*[2]

[1] Public Lands Institute and Department of Environmental Studies, University of Nevada Las Vegas, 4505 S. Maryland Parkway, Las Vegas, NV 89154-2040, U.S.A.

[2] National Park Service, Lake Mead National Recreation Area, 601 Nevada Way, Boulder City, NV 89005, U.S.A.

Abstract

Land managers need ecologically and cost-effective strategies for revegetating arid lands, such as the Mojave Desert in the southwestern United States. Many disturbances – failed agricultural attempts, grazing by exotic herbivores (e.g., burros, cattle), creating roads, land clearing for military or mining activities, off-road vehicle use, and wildfires fueled by exotic grasses – have modified or eradicated native vegetation. Natural revegetation often is slow, or consists of exotic species that do not meet management objectives. As a result, active revegetation using native species may be required to accomplish ecological and utilitarian objectives, such as enhancing native plant communities, curtailing fugitive dust that poses a human health hazard, or establishing non-flammable vegetation for reducing wildfires. We evaluated the following questions by systematically reviewing published revegetation studies in the Mojave Desert: (1) Which species have been most commonly and effectively planted or seeded? (2) Which treatments have increased plant establishment? (3) What are the relative performances of planting and seeding, and are these species specific? Fifteen planting studies assessed a total of 41 species, 33 of them shrubs. None of the nine species planted in ≥ 3 studies avoided a complete failure (0% survival) in one or more treatments in one or more studies, but several species (e.g., *Larrea tridentata*, *Atriplex* spp.) consistently exhibited high (> 50%) survival. Fencing, shelters, and irrigation increased survival of some species, but these treatments require cost/benefit analyses. Though seeding frequently has been discouraged relative to planting, seeding success is species and situational specific.

2009

Literature Review:

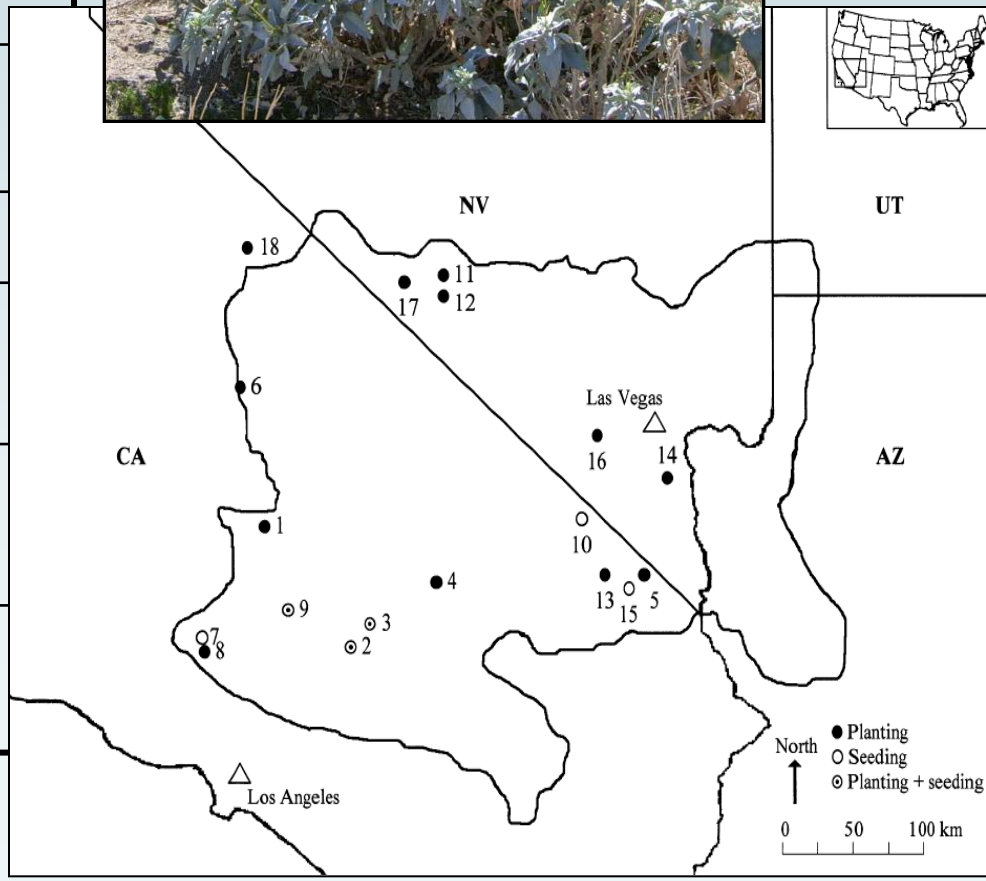
Planting/seeding research in the Mojave

UNLV-NPS partnership

Results: Summary of Studies

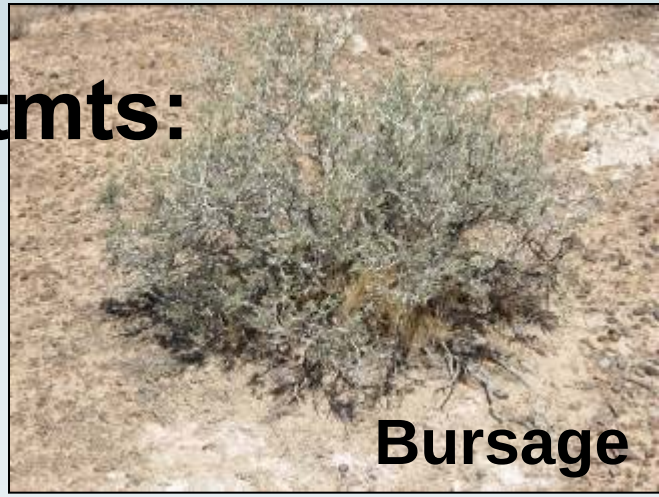
	Planting	Seeding
No. studies	13	8
Environments, e.g.	Corridors, mine spoil	Old road, ag land
Precipitation (%)	27-148	33-157
No. spp/study	1-21	3-12
Care, e.g.	Irrigation, cages	Less common
Tmts tested, e.g.	Shelters, cages	Less common
Years monitored	1-5	1-5

Brittle-bush



Planting – species comparisons

- 40 total species, 36 of them shrubs
- 16 species planted in ≥ 2 studies
- ≥ 50% survival in 1 or more tmts:
  - White bursage 5/9 studies
  - Creosote 5/7 studies
  - Fourwing saltbush 4/5, alkali saltbush 2/3
  - Nevada jointfir (*Ephedra*), cheesebush (*Hymenoclea*), Mojave yucca 2/2


Bursage

Seeding – Species Comparisons

- **26 total species**
  - **White bursage est. in 3/3 studies (e.g. 0.1/m^2)**
  - **Saltbush spp. 3/3 (e.g., 0.6-4.2/m^2)**
  - **Creosote fails in 2/3 studies**
  - **In study of 12 spp: Palmer's penstemon 7 plants/m^2, desert marigold 3 plants/m^2**

Saltbush

Marigold

Planting and Seeding Comparisons

- **Few studies directly compared methods**
- **In comparing separate studies:**
  - **Bursage and saltbush perform well in both planting and seeding**
  - **Creosote performs well in planting but poorly in seeding**

DriWater + grazing protection, Lake Mead NRA Northshore Road

Thoughts

- **Species specificity**
- **Species that establish infrequently in nature (e.g., late successional creosote), establish better by planting than by seeding w/o supplemental tmt**
- **Species that need little tmt for establishing are a key for reveg**
- **Multifactor studies essential**
- **Reveg can meet management objectives in certain contexts**
- **Publication bias**
- **Saguaro, Joshua Tree NP, Mojave, L.A. DeFalco**

Using a diverse seed mix to establish native plants on a Sonoran Desert burn

Scott R Abella, John L Gunn, Mark L Daniels, Judith D Springer, and Susan E Nyoka

ABSTRACT

Revegetating burns is a major challenge facing resource managers in the low- and unpredictable-precipitation deserts of the southwestern US. We monitored the effectiveness of using a diverse, 28-species seed mix for establishing native plants on a 1.5-ha (3.7-ac) burn in the northern Sonoran Desert. Our objective was to compare species performances, which we assessed by measuring species frequencies and cover on 5 sampling dates to capture variation during a 32-mo period following seeding. By 15 mo after seeding, desert senna (*Senna covesii* (Gray) Irwin & Barneby [Fabaceae]) established best, with a frequency of 91% (based on 22, 10-m^2 plots) and a relative cover of 19%. Four other seeded species also became established in ≥50% of plots by 32 mo after seeding. Several seeded species, including desert senna (which flowered only 7 wk after seeding) and purple threeawn (*Aristida purpurea* Nutt. [Poaceae]), were observed with seed heads during one or more sampling periods. Although precipitation was only 67% of normal for 21 mo following seeding and 71% of species established in < 10% of plots, we consider the seeding to have met short-term management objectives because of the subset of highly successful species. Our results also illustrate the caution that should be used when evaluating seeding success: conclusions would have differed if the diversity of the seed mix had not included the successful species, and longer term monitoring was needed to detect some species in the seed mix that did not establish until 32 mo after seeding.

Abella SR, Gunn JL, Daniels ML, Springer JD, Nyoka SE. 2009. Using a diverse seed mix to establish native plants on a Sonoran Desert burn. Native Plants Journal 10(1):21–31.

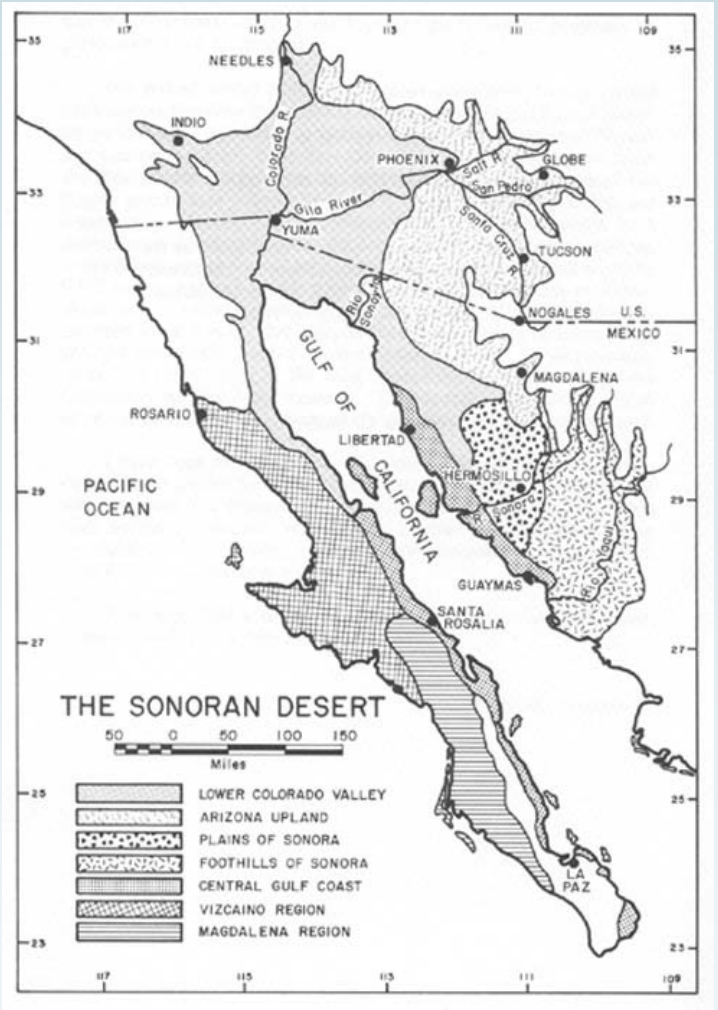
KEY WORDS
fire, revegetation, seeding, species selection, mulch, *Senna covesii*

NOMENCLATURE
USDA NRCS (2007)

Revegetating burned areas is a formidable challenge facing resource managers in arid lands of the southwestern US. Southwestern deserts, such as the Sonoran, are not generally thought to have a history of frequent burns. Multiple ignition sources combined with increased fuel loads (often resulting from invasion of exotic annual grasses and increased density of nonpalatable shrubs), however, have increased frequencies, sizes, and severities of wildfires (Schmid and Rogers 1988). Many long-lived native species in these deserts are not considered fire adapted (Brown and Minnich 1986). Natural revegetation of desert burns by native species may be slow or dominated by exotic annual grasses that perpetuate a frequent-fire regime (Cave and Patten 1984). For example, Guo (2004) found that species richness of native perennial plants continued to increase up to 60 y following protection from disturbance in the Sonoran Desert. This implies a long recovery time for these native perennial communities. In

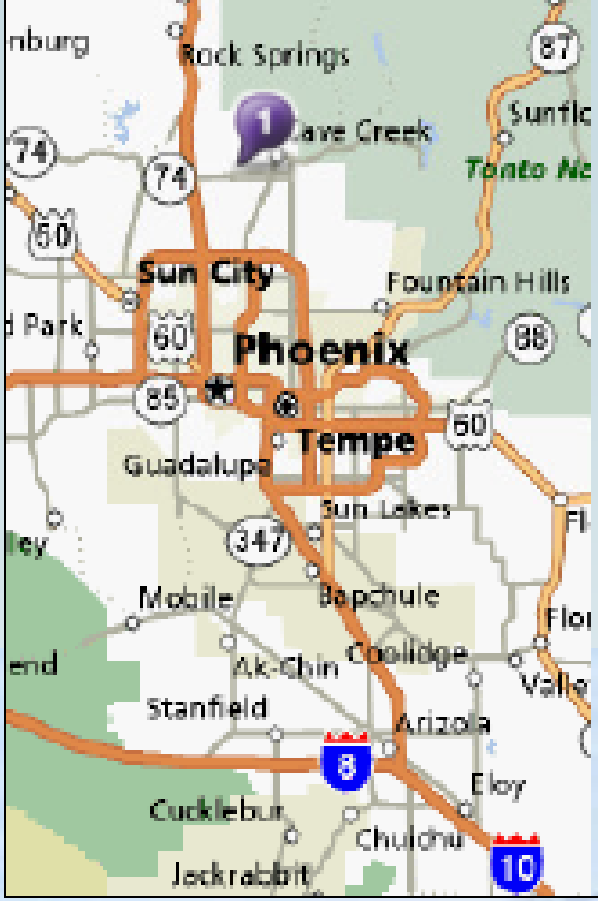
Screening species:

Sonoran uplands

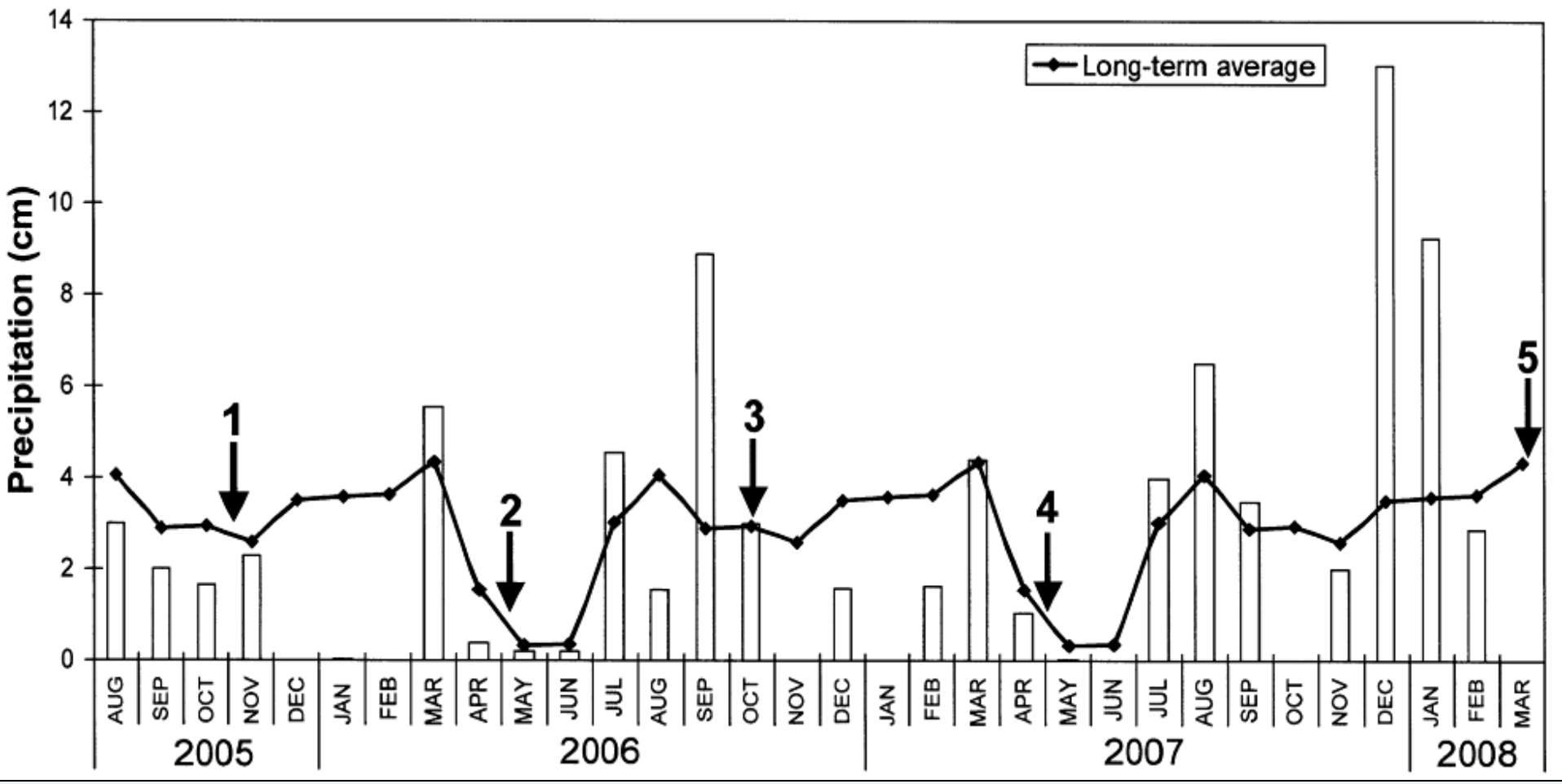


Testing Diverse Seed Mix

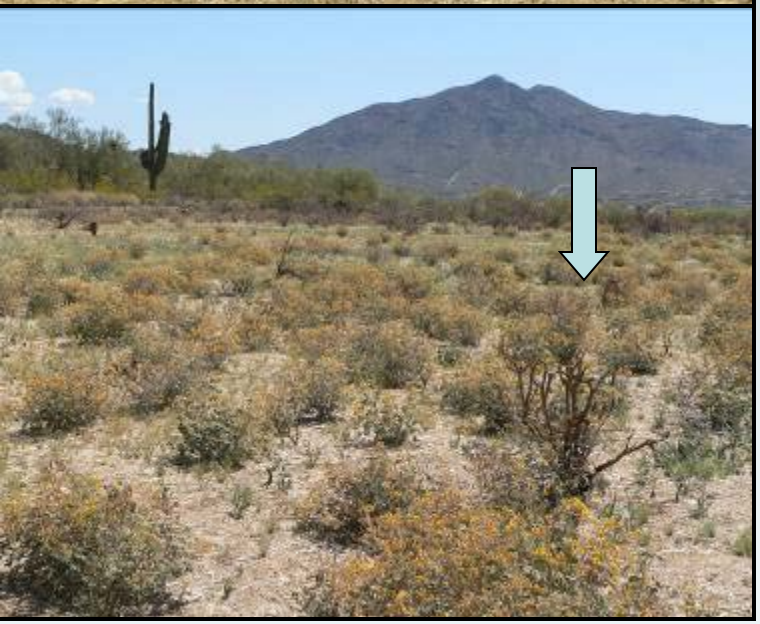
- Cave Creek Regional Park, Sonoran Desert uplands
- 28 natives seeded



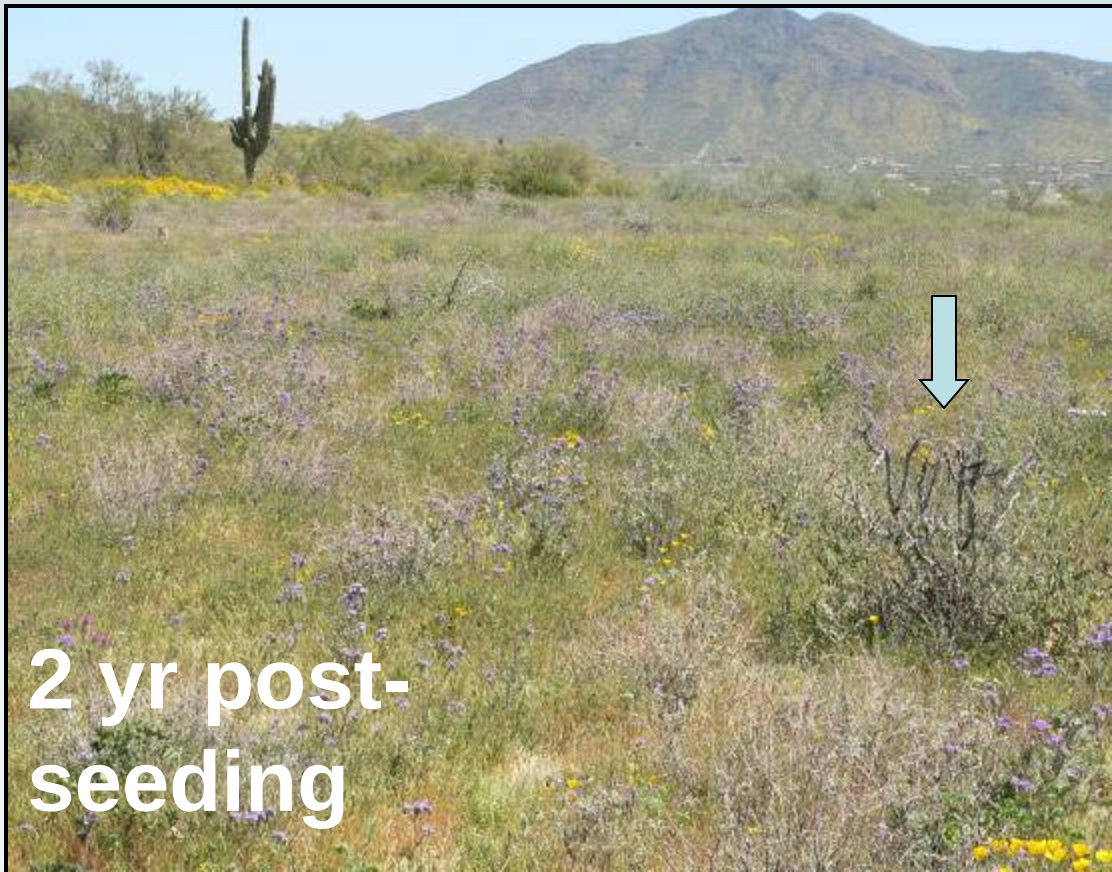
Precip. only 67% of “normal”



3 mo post-seeding

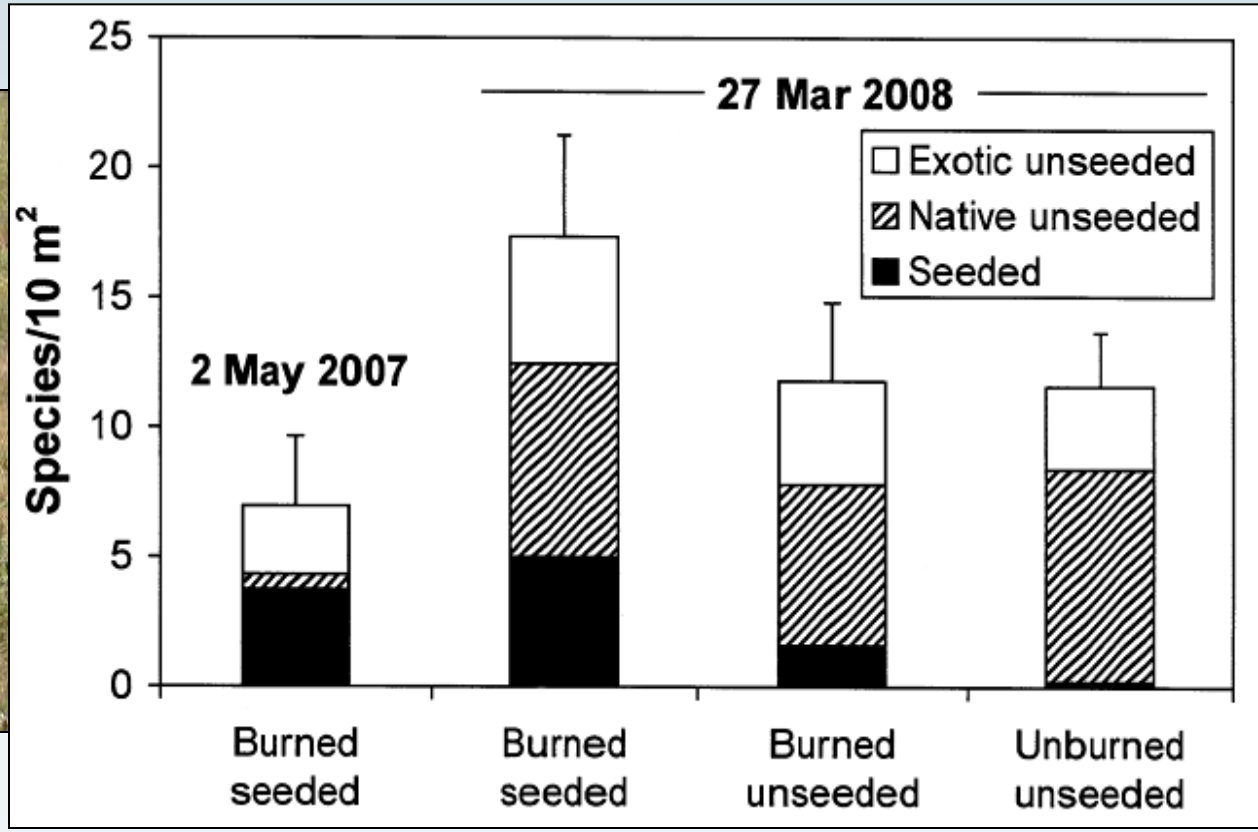


6 mo post-seeding



Species Establishment

- **Of 28 seeded species, highly successful subset of 7 species made seeding successful, at least in the short term (32 months)**
- **Desert senna, purple threeawn, desert bluebells**



ABSTRACT

We found that the most effective and economical method for establishing native shrubs on extensive areas of retired cropland in southern Arizona makes use of drip irrigation and 3.8-l (1-gal) transplants (outplants). In March 2001, we established a small (8 ha [20 ac]) field trial to test the effectiveness of different combinations of transplanting, seeding, drip irrigation, and furrow irrigation. Treatments utilizing transplants and drip irrigation had higher survival and lower densities of weed species than other treatments tested. Based on these results, we planted again in November 2001 using drip-irrigated transplants to examine the effectiveness of this method over a larger scale (85 ha [210 ac]). As a further refinement of this method, we tested various sizes of container stock and determined that transplants of 3.8-l (1-gal) size had superior growth and survival when compared to smaller-sized transplants. The total cost of this method is approximately US$ 4430/ha ($1790/ac), but it is more likely to succeed as compared with direct seedings, which is a commonly used approach to revegetation in southwestern ecosystems. Although a drastic effort, our technique holds promise for revegetating environments in the hottest and driest parts of the Sonoran Desert in southern Arizona.

Intensive revegetation in

ARIZONA'S HOT DESERT

The advantages of container stock

Travis M Bean
Steven E Smith
Martin M Karpiscak

Native Plants Journal

2004

Sonoran, southern AZ

Three-year budget for the revegetation of a native plant community using drip irrigation in Maricopa County, Arizona. All rates and costs in US$.

Operation	Rate	Materials		Labor		Cost per hectare [a]
		Type	*Cost*	*Hours*	*Cost*	
LAND PREPARATION						
Scrape field [b]	52					52
Burn residue				2.5	69	69
Install drip irrigation		Drip system and tape	1235	29.6	230	1465
Apply pre-emergent herbicide [c]		Pendimethalin	29	0.7	32	61
Pre-irrigate [d,e]		Water (12000 l) [d]	3			3
PLANTING						
Plants [f]		3.8-l plants	783			783
Unload delivery truck [g]				2.5	19	19
Deliver inside field, hand plant, and stack containers				59.3	459	459
MAINTENANCE						
Irrigate [h]		Water (740 000 l) [i]	179			179
Hand weeding [j] (3X)	556					556
Drip system maintenance [k] (3X)		Chemicals (chlorine)	185			185
Subtotal						3965
15% Contingency [l]						595
Total						4426

Soil Restoration

REVIEW

Biological Soil Crust Rehabilitation in Theory and Practice: An Underexploited Opportunity

Matthew A. Bowker[1,2]

MARCH 2007 *Restoration Ecology Vol. 15, No. 1, pp. 13–23*

Abstract

Biological soil crusts (BSCs) are ubiquitous lichen–bryophyte microbial communities, which are critical structural and functional components of many ecosystems. However, BSCs are rarely addressed in the restoration literature. The purposes of this review were to examine the ecological roles BSCs play in succession models, the backbone of restoration theory, and to discuss the practical aspects of rehabilitating BSCs to disturbed ecosystems. Most evidence indicates that BSCs facilitate succession to later seres, suggesting that assisted recovery of BSCs could speed up succession. Because BSCs are ecosystem engineers in high abiotic stress systems, loss of BSCs may be synonymous with crossing degradation thresholds. However, assisted recovery of BSCs may allow a transition from a degraded steady state to a more desired alternative steady state. In practice, BSC rehabilitation has three major components: (1) establishment of goals; (2) selection and implementation of rehabilitation techniques; and (3) monitoring. Statistical predictive modeling is a useful method for estimating the potential BSC condition of a rehabilitation site. Various rehabilitation techniques attempt to correct, in decreasing order of difficulty, active soil erosion (e.g., stabilization techniques), resource deficiencies (e.g., moisture and nutrient augmentation

ulation). Succ

evaluation of

of constraints

BSCs is attain

some ecosyste

on ecosystems

storationists t

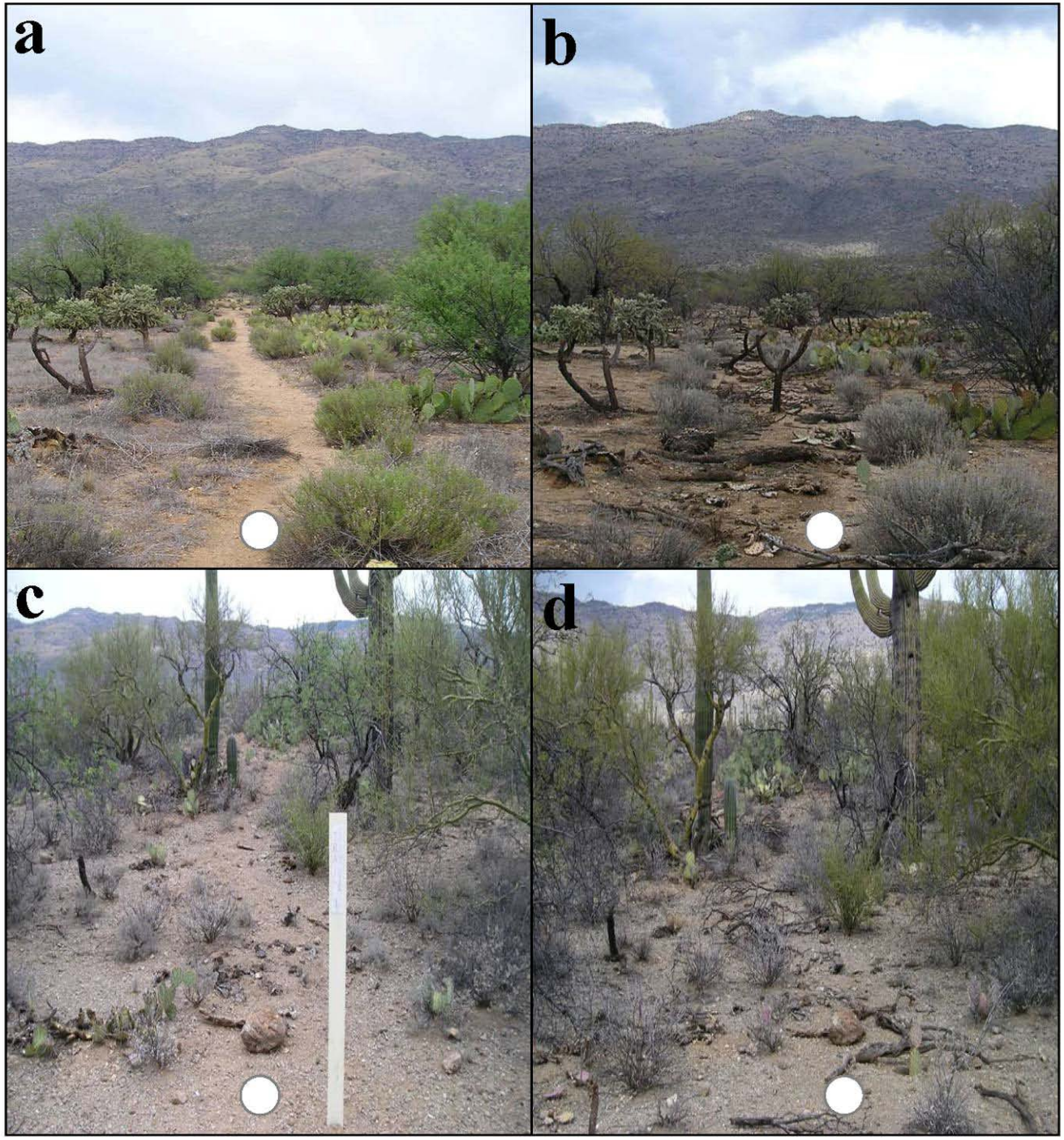
trajectory.

Key words: ar

degradation

succession.

Soil crust treatments, Lake Mead NRA



Saguaro Natl Park

Vertical mulching

Outplanting success

Courtesy of D. Backer

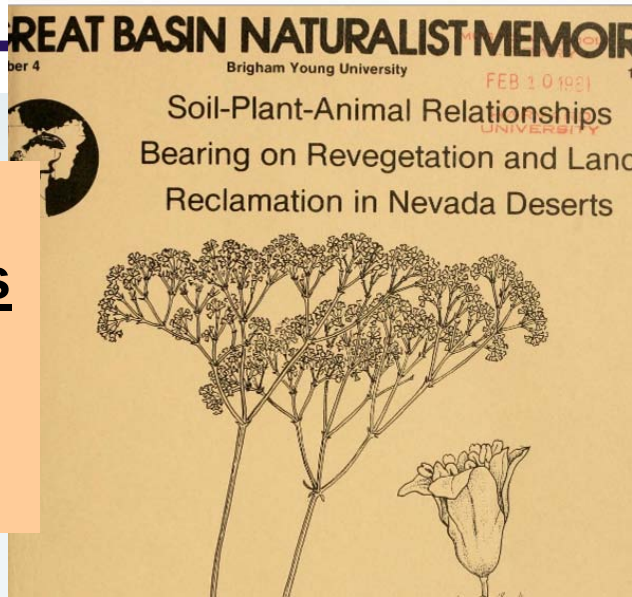
Restoring structure

The role of nurse plants in the restoration of degraded environments

Francisco M Padilla* and Francisco I Pugnaire

Traditional ecological models have focused mainly on competition between plants, but recent research has shown that some plants benefit from closely associated neighbors, a phenomenon known as facilitation. There is increasing experimental evidence suggesting that facilitation has a place in mainstream ecological theory, but it also has a practical side when applied to the restoration of degraded environments, particularly drylands, alpine, or other limiting habitats. Where restoration fails because of harsh environmental conditions or intense herbivory, species that minimize these effects could be used to improve performance in nearby target species. Although there are few examples of the application of this "nursing" procedure worldwide, experimental data are promising, and show enhanced plant survival and growth in areas close to nurse plants. We discuss the potential for including nurse plants in restoration management procedures to improve the success rate of such projects.

Front Ecol Environ 2006; 4(4): 196–202



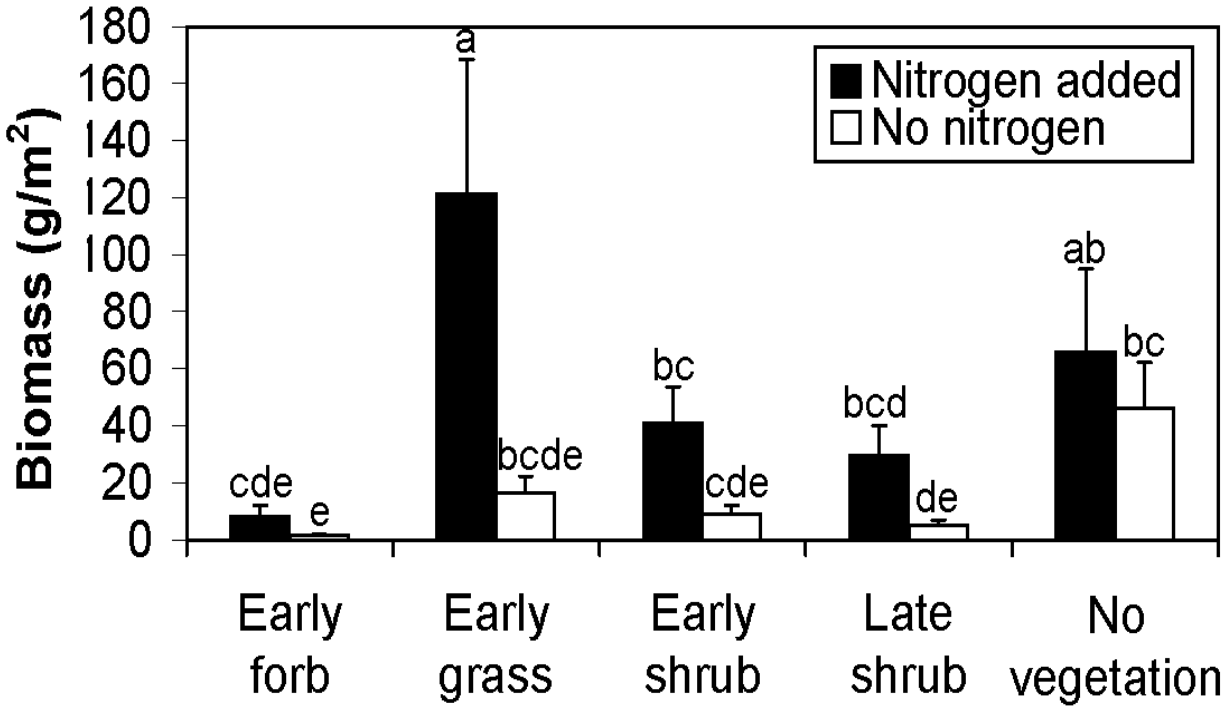
Romney et al. (1980) The challenge of a desert: revegetation of disturbed desert lands

- **Stressed soil fertility, fertile islands**
- **But is this good???**

Constraining exotic species

- **Invasion-reducing communities**
- **Five community types: early forb, early shrub, grass, late shrub, none**
- **Each of 12 species also grown individually**
- ***Bromus* or *Schismus* added, nitrogen added or not**

Invasibility Community Experiment: Results



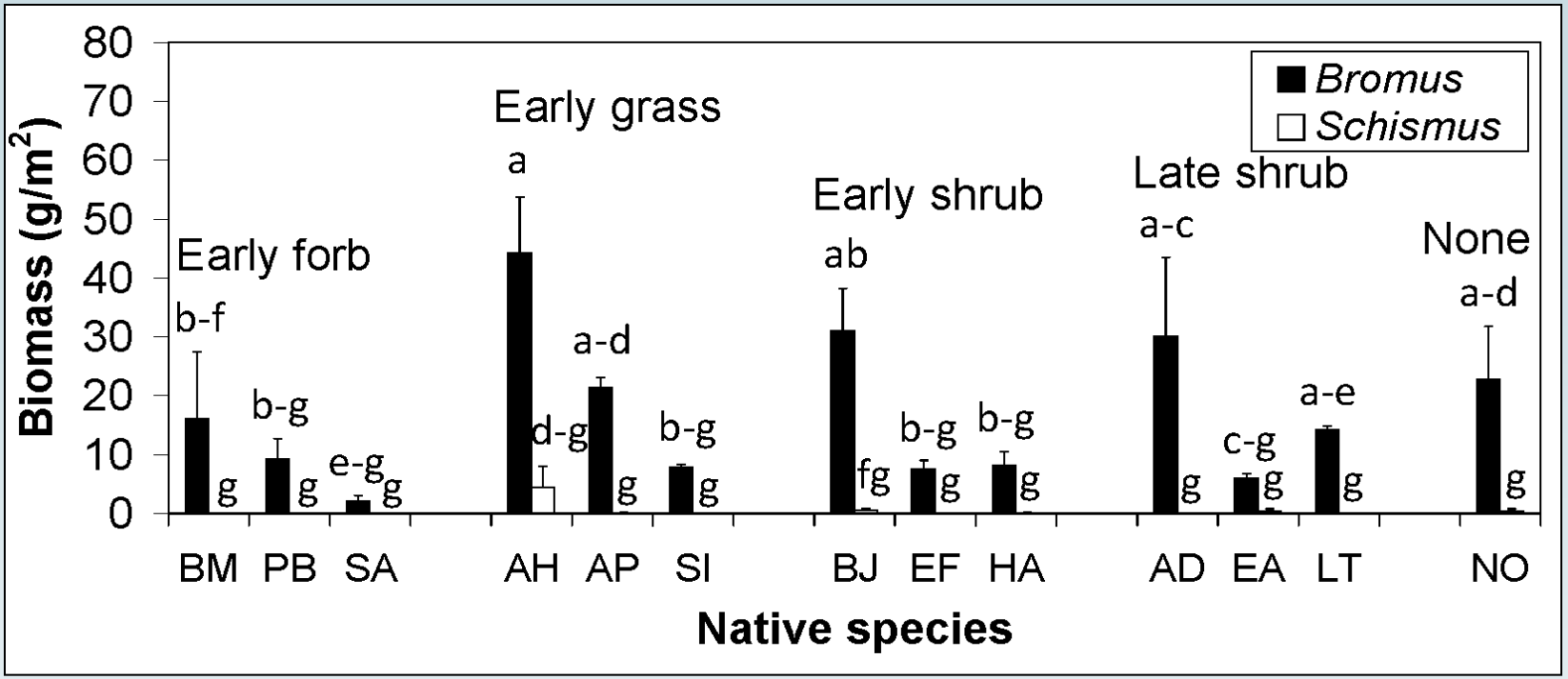
Early forb:
Baileya multiradiata
Penstemon bicolor
Sphaeralcea ambigua

Early grass:
Achnatherum hymenoides
Aristida purpurea
Sporobolus airoides

Early shrub:
Bebbia juncea
Encelia farinosa
Hymenoclea salsola

Late shrub:
Ambrosia dumosa**
Eriogonum fasciculatum
Larrea tridentata

Invasibility Species Experiment: Results



***Sphaeralcea ambigua* (SA – desert globemallow): 11-fold reduction**

Cover of natives not sig. related to exotic biomass

Globemallow

Invasive Plant Science and Management 2011 4:115–124

Relationships of Native Desert Plants with Red Brome (*Bromus rubens*): Toward Identifying Invasion-Reducing Species

Scott R. Abella, Donovan J. Craig, Lindsay P. Chiquoine, Kathryn A. Prengaman, Sarah M. Schmid, and Teague M. Embrey*

The interactions between native and exotic species occur on a continuum from facilitative to competitive. A growing thrust in invasive species science is differentiating where particular native species occur along this continuum, with practical implications for identifying species that might reduce the invasibility of ecosystems. We used a greenhouse experiment to develop a competitive hierarchy of 27 native species with red brome, an invasive annual grass in the arid lands of the southwestern United States, and a field study to assess in situ responses of brome to native perennial species in the Mojave Desert. Native species most competitive with brome in the competition experiment included the annuals Esteve's pincushion and western fiddleneck and the perennials eastern Mojave buckwheat, sweetbush, and brittlebush, which reduced brome biomass to 49 to 70% of its grown-alone amount. There was no clear difference in competitive abilities with brome between annual and perennial natives, and competiveness was not strongly correlated ($r = 0.15$) with the biomass of the native species. In the field, sweetbush and brittlebush supported among the least cover of brome, suggesting congruence of the strong early competitive abilities of these species with in situ patterns of brome distribution. At the other extreme, brome attained its highest average cover (19%) below littleleaf ratany, significantly greater than all but 3 of the 16 species evaluated. Cover by brome was only weakly related ($r = 0.19$) to the area of the perennial canopy, suggesting that factors other than the sizes of perennial plants were linked to differences in brome cover among species. Results suggest that (1) interactions with brome differ substantially among native species, (2) these interactions are not as closely linked to biomass production as in more temperate regions, and (3) there is potential for identifying native species that can reduce invasion of desert ecosystems.

Correlation Study: Methods & Results

- **7 sites, *in situ* patterns**
- **Categorize *Bromus* cover below perennials**

Microsite	Median	95% CI[a]	n[b]
Interspace	1 a	1-2	56
Thamnosma montana	2 ab	2-5	22
Bebbia juncea	2 abc	0-9	7
Encelia virginensis	2 abc	1-19	7
Salazaria mexicana	2 abc	2-9	9
Encelia farinosa	3 bc	2-5	30
Coleogyne ramosissima	5 abc	2-5	40
Pleuraphis rigida	5 abcd	2-9	6
Menodora spinescens	5 bc	5-5	37
Psorothamnus fremontii	5 bc	2-9	29
Ambrosia dumosa	5 c	5-9	22
Eriogonum fasciculatum	5 bc	2-38	11
Gutierrezia sarothrae	5 bc	2-9	11
Hymenoclea salsola	9 bcd	2-38	10
Larrea tridentata	9 bcd	2-38	13
Ephedra torreyana	9 c	5-19	28
Krameria erecta	19 d	19-19	37

- ***Bromus* cover varied 19-fold among interspaces and native perennial plant microsites**

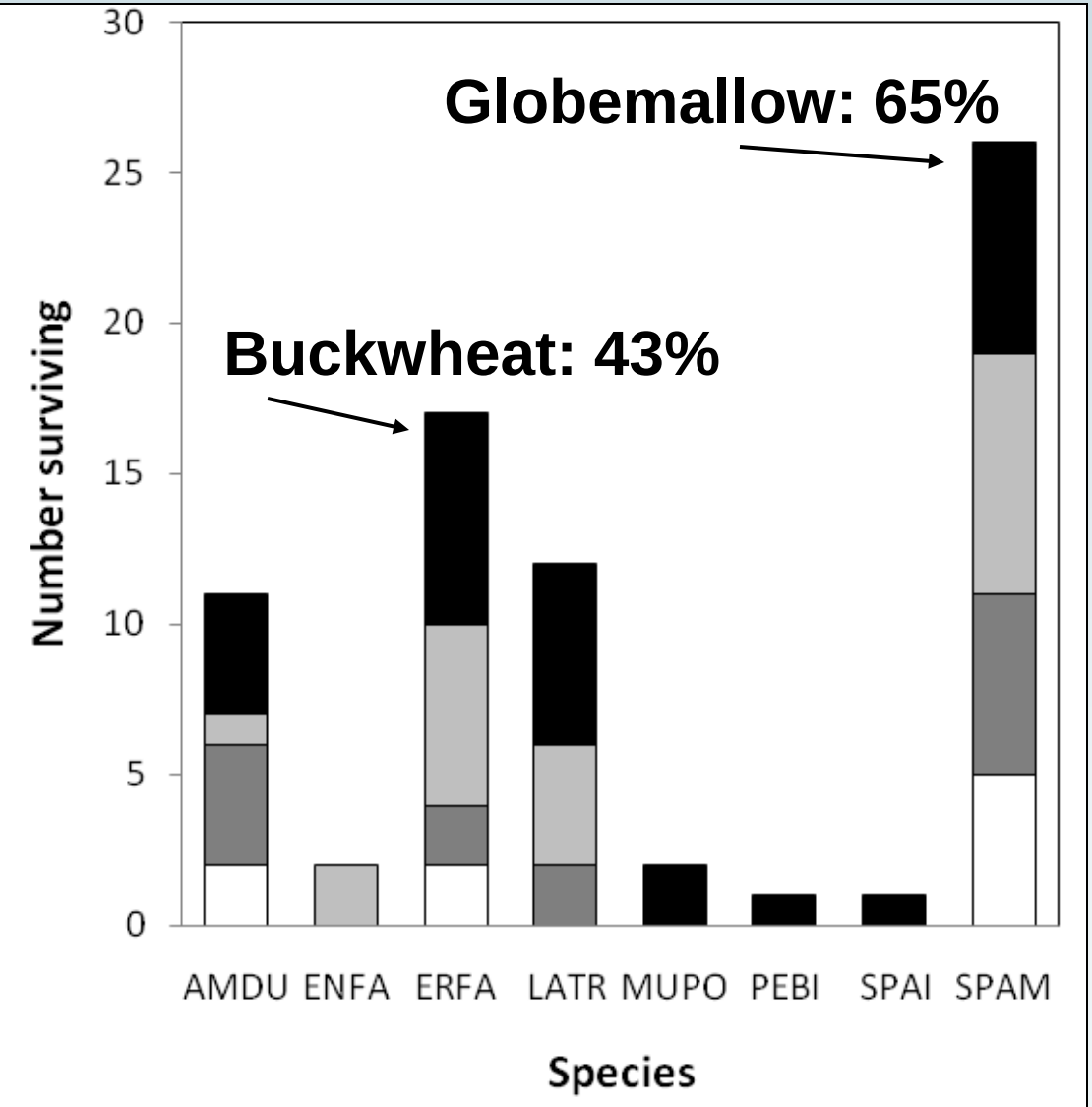
Comparing Results

Species	This study: competition	This study: field	Brooks* (2009): field
Ambrosia dumosa	Medium	Medium	Good
Bebbia juncea	Good	Good	Good
Coleogyne ramosissima	—	Medium	Medium
Eriogonum fasciculatum	Good	Medium	Medium
Hymenoclea salsola	Medium	Poor	Medium
Krameria erecta	—	Poor	Medium
Larrea tridentata	Medium	Poor	Medium
Psorothamnus fremontii	—	Medium	Poor
Salazaria mexicana	Good	Good	Poor
Thamnosma montana	—	Good	Poor

***Pp. 101-124 in The Mojave Desert: Ecosystem Processes and Sustainability. Univ. Nevada Press.**

Reality Check: Results

- **Planting effective, seeding not**



Globemallow

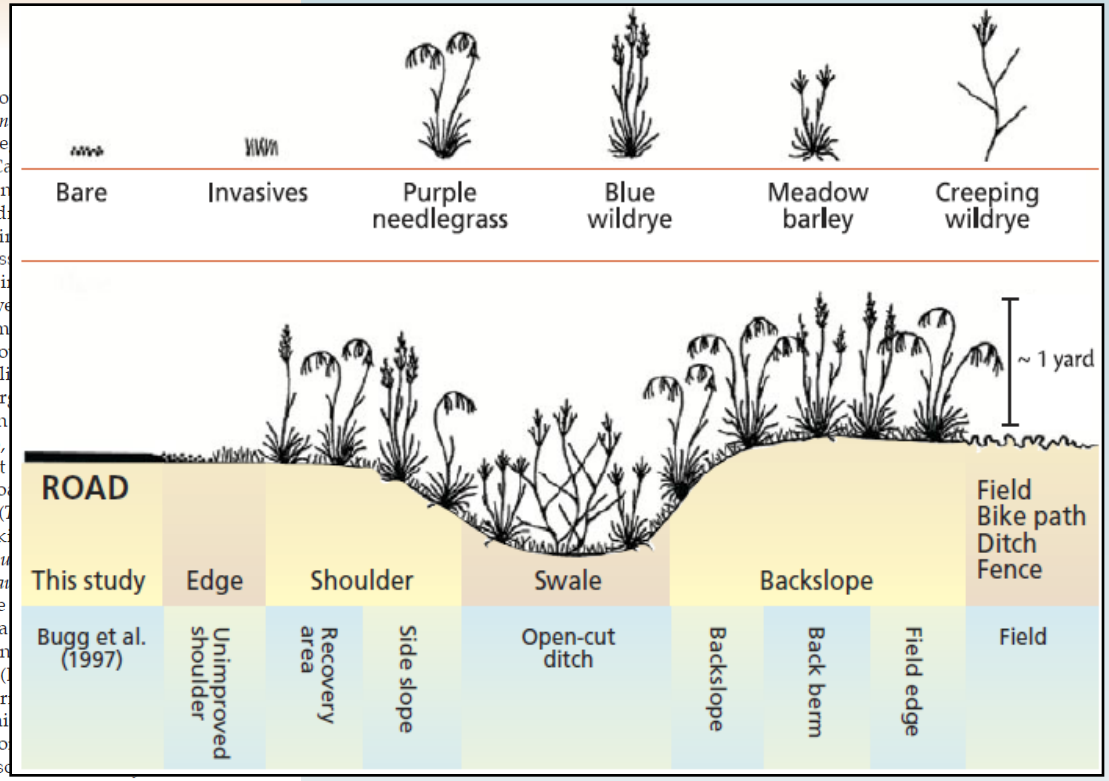
Native roadside perennial grasses persist a decade after planting in the Sacramento Valley

by Ryan E. O'Dell, Stephen L. Young
and Victor P. Claassen

Restoring native grassland along roadsides can provide a relatively low-maintenance, drought-tolerant and stable perennial vegetative cover with reduced weed growth, as opposed to the high-maintenance invasive annual cover (requiring intensive mowing and herbicide treatments) that dominates most Sacramento Valley roadsides. A survey of long-established roadside native-grass plantings in Yolo County showed that once established and protected from disturbance, such plantings can persist with minimal maintenance for more than a decade, retaining a high proportion of native species. The survey also showed that each species of native perennial grass displays a microhabitat preference for particular roadside topographic positions, and that native perennial grass cover is negatively affected by disturbance.

Grasslands cover approximately 17% (almost 20 million acres) of California's landscape (Huenneke and Mooney 1989). Although the range of California's grassland communities has changed little since European settlement more than 200 years ago, their species composition has been altered dramatically. Heavy livestock grazing, cultivation, wildfire suppression and the introduction of annual species from the Mediterranean have transformed California's once-pristine and diverse grasslands, which were dominated by perennial bunchgrasses, to invasive, annual-dominated grasslands with lower species diversity (Dyer and Rice 1997; Heady et al. 1992; Huenneke and Mooney 1989). Less than 10% of California native perennial grassland is estimated to remain (Huenneke and Mooney 1989).

The remaining perennial grasslands in California's interior are dominated by the native species purple needlegrass (*Nassella pulchra* [A. Hitchc.] Barkworth), blue wildrye (*Elymus glaucus* Buckley), bluegrass (*Poa secunda* J.S. Presl.), California melic (*Melica californica* Scribner), creeping wildrye (*Leymus triticoides* [Buckley] Pilger) and



At relatively undisturbed site 1 (looking west), vegetation from the road edge (left) to swale (bottom right to center) is dominated by the native perennial purple needlegrass. The swale is periodically inundated in winter and contains a few individuals of the native perennial meadow barley distributed among a dense cover of common vetch (*Vicia sativa*), an invasive annual.

The road edge of heavily traveled site 4 (looking east) is bare (bottom right to center). A dense strip of stunted, invasive annual grasses (Italian ryegrass and foxtail barley) occurs to the left of the road edge on the shoulder (bottom center to center). A strip of the native perennial purple needlegrass occurs on the much-less-disturbed backslope (bottom left to center).

Understanding not just site suitability, but microsites for enhancing outplant establishment

Implications of Findings

- **Planting works; Seeding uncertain; Cost-benefit.**
- **Species selection; Specificity; Propagule increase.**
- **Soil ER – successful one level, infancy other.**
- **Attention to function and objectives, succession.**

Acknowledgements:

Funding. Alice C. Newton and the National Park Service, Lake Mead National Recreation Area (LMNRA), Joint Fire Science Program, Maricopa County, Arizona, Parks and Recreation Department (J. Gunn), Parashant NM (K. Harcksen), and Saguaro NP (D. Backer).

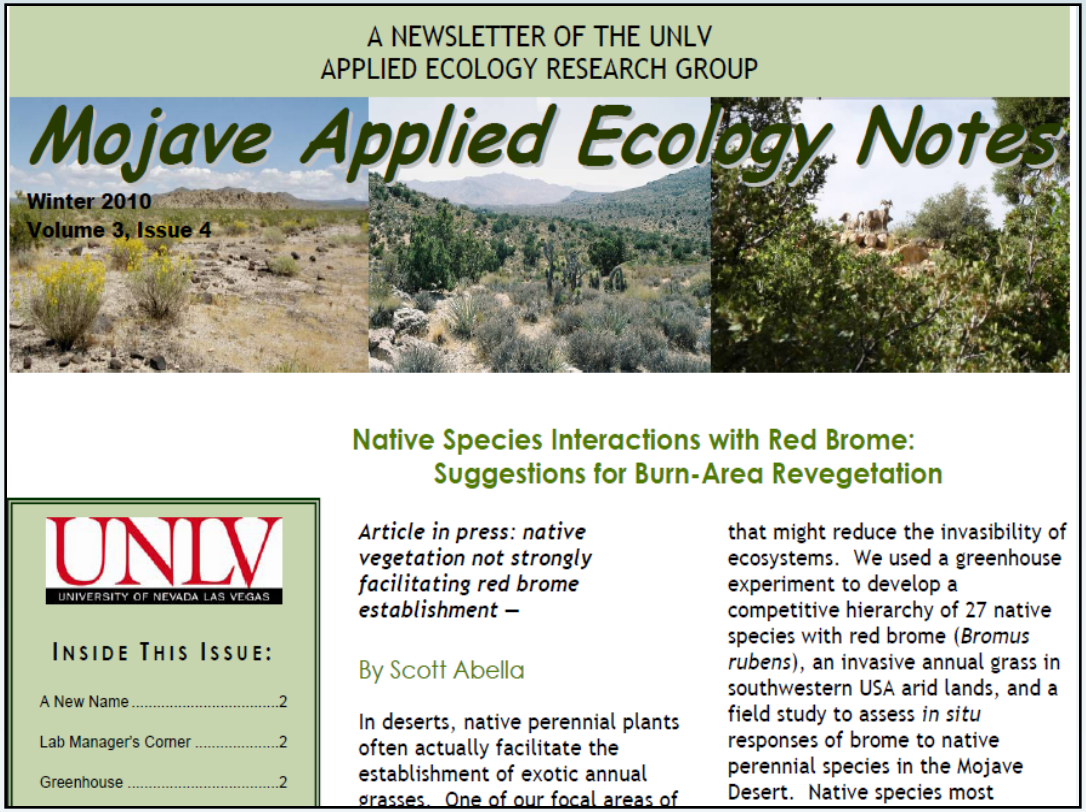
Data collection. UNLV students and staff of the Applied Ecology Group.

Thanks to Sharon Altman (UNLV) for help preparing the presentation.

Scott R. Abella
scott.abella@unlv.edu

Department of Environmental and Occupational Health

UNLV
UNIVERSITY OF NEVADA LAS VEGAS



A NEWSLETTER OF THE UNLV
APPLIED ECOLOGY RESEARCH GROUP

Mojave Applied Ecology Notes

Winter 2010
Volume 3, Issue 4

UNLV
UNIVERSITY OF NEVADA LAS VEGAS

INSIDE THIS ISSUE:

A New Name 2
Lab Manager's Corner 2
Greenhouse 2

Native Species Interactions with Red Brome:
Suggestions for Burn-Area Revegetation

Article in press: native vegetation not strongly facilitating red brome establishment –

By Scott Abella

In deserts, native perennial plants often actually facilitate the establishment of exotic annual grasses. One of our focal areas of

that might reduce the invasibility of ecosystems. We used a greenhouse experiment to develop a competitive hierarchy of 27 native species with red brome (*Bromus rubens*), an invasive annual grass in southwestern USA arid lands, and a field study to assess *in situ* responses of brome to native perennial species in the Mojave Desert. Native species most

Global Distribution of Arid Lands