Case Histories

Natural landscapes modified by grazing

- Huddleston, R.T. and T.P. Young. 2004. Spacing and competition between planted grass plugs and pre-existing perennial grasses in a restoration site in Oregon. Restoration Ecology 12(4):546-551

- Competition between native and exotics often limits restoration success.
  - Usually exotic density is a critical component
- Competition between native seedlings and established natives can also limit.
  - Competitive effects are often greatest among natives with similar morphologies.

- Gap size may have a positive effect on seedling establishment
  - Especially if seedlings are poor competitors for light and soil resources

- Study site
  - Agate Desert, central Rogue River Valley, SW Oregon
  - Mounded
  - 467 mm (18.6") precip per yr, dry summers
  - Vernal pools (impermeable clay loam layer)
  - Grazed

- Historical vegetation
  - *Pseudoroegneria spicata* (bluebunch wheatgrass)
  - *Festuca idahoensis* (Idaho fescue)
  - *Poa secunda* (pine bluegrass)
  - *Acnatherum lemmonii* (Lemmon's needlegrass)
  - *Elymus elymoides* (squirreltail)
  - *Bromus carinatus* (California brome)

- Current non-natives
  - *Bromus hordeaceus* (soft chess)
  - *Taeniatherum caput-medusae* (medusa head)
  - *Vulpia myuros* (rattail fescue)

- Restoration was done with plugs
  - Idaho fescue and bluebunch wheatgrass
  - 5x5x13 cm containers (2x2x5")
  - Grown in potting soil
  - Planted in 6" deep augered holes
  - No water, no fertilizer

Experiment

- Site was burned and seeded with *A. lemmonii* in 1996 at 400 seeds/m^2
- Chain harrowed after seeding
- Sixteen 1x5 m plots established in 1999
- *A. lemmonii* density variable
  - Experimental plots stratified into 4 density levels
  - High density 17-25 *A. lemmonii*/m^2
  - Low density 0 *A. lemmonii*/m^2

- In each plot 18 seedlings planted (half Idaho fescue, half bluebunch wheatgrass)
- Seedlings 6, 12 or 18 cm from existing A. lemmonii tussock
- 2 month old plugs planted October 1999

- Results (by June 2000)
  - Idaho fescue basal growth significantly less at 6 cm spacing than control (with no competition)
  - Bluebunch wheatgrass significantly less at 18 cm spacing
  - Idaho fescue flowering showed no response
  - Bluebunch wheatgrass flowered more at 18 cm than at 6 or 12.

- Dyer, A.R. 2002. Burning and grazing management in a California grassland: effect on bunchgrass seed viability. Restoration Ecology 10(1):107-111

Jepson Prairie Reserve

- Burning and grazing management are used in California grasslands to control invasives.
- Sometimes there is a positive effect on native species.
- Fire and grazing-adapted species sometimes respond with increased growth and seed production
  - Depends on timing and intensity of defoliation

- One aspect of native response is the seedbank.
  - Questions: does management result in higher quality seeds?

Experiment

- In 1988 a burning and grazing experiment was done
  - Jepson Prairie Preserve, near Sacramento
  - Plots received a combination of burning and grazing
- Results:
  - Less seed but bigger seeds after fire
  - There was only a weak grazing effect

- Seedbank question
  - Seeds from same experiment were stored for ten years then germinated.
  - Seed mass was a significant determinant of responses.
  - Burn seeds were 20% larger and had a 72% higher probability of germination after 10 y.
  - Combined burning and grazing produced largest seeds and highest germination rates
  - Plants grazed but not burned produced smallest seeds and lowest germination rates.

- Ansley, R.J. and M.J. Castellano. 2006. Strategies for savanna restoration in the southern Great Plains: effects of fire an herbicides. Restoration Ecology 14(3):420-428

Summer mesquite burn

Texas Agricultural Experiment Station, Vernon

- Woody plant encroachment has degraded grassland and savannas worldwide
- Grazing decreases fuel, less fire results in more woody species, which do not burn on their own.
- Resulting woodlands have lower biodiversity, lower herbaceous production, increase in bare ground

- *Prosopis glandulosa* (honey mesquite) has invaded much of south Great Plains grassland and savanna.
- Grassland with cattle will evolve to a mesquite woodland in a large geographic area.
  - Cattle suppress grass fuel load
  - Spread mesquite seeds in cow pies

- Potential responses
  - Fire is economical in arid regions, but there is cultural resistance to burning.
    - Also, fire only top kills mesquite and it will basally sprout.
  - Herbicide is more expensive but kills mesquite better

- Most ranchers assume 100% grassland maximizes herbaceous production.
  - However, grass production increases with a light canopy cover
  - Decreases after a threshold of cover is reached
  - Light canopy cover also provides wildlife habitat, which makes process societally more palatable.

Experiment

- Three treatments
  - 1. 1:1 clopyralid and triclopyr (Garlon)
    - Applied by aircraft
    - Kills mesquite
  - 2. Prescribed fire
    - Suppresses mesquite, but only 5% kill
  - 3. Low rate clopyralid
    - Creates moderate whole plant mortality (20-40%)
    - Does not cause basal sprouting

- Site S.E. of Vernon, Texas
- Rainfall 677 mm (27"/y)
- 50% canopy cover
- C3 grasses
  - *Nasella leucotricha* (Texas wintergrass)
  - *Bromus japonicus* (Japanese brome)
- C4 grasses
  - *Bouteloua curtipendula* (sideouts grama)
  - *Sporobolus compositus* (meadow dropseed)
  - *Buchloe dactyloides* (buffalo grass)

- Treatments: 4 reps each of 3 treatments and a control.
  - Fire applied Jan 1996
  - Herbicide applied Jul 1996
- After 3 years, mesquite evaluated for mortality, stem sprouts, basal sprouts

- Results:
  - Mesquite height
    - control>C >fire>CT
  - Cover
    - control>fire>C>CT
  - Fewest basal sprouts in C treatment
  - Highest herbaceous production in C and CT
  - Fire created heavy basal sprouting that suppressed grasses and forbs.