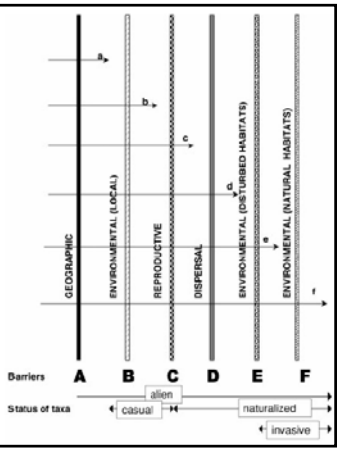
Biological Invasions

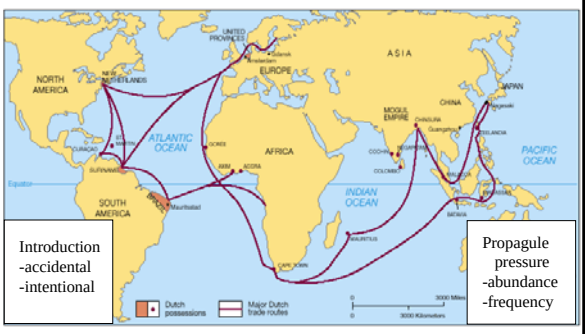
Terms

- Introduction
- Naturalization
- Invasion
- Encroachment
- Colonization



From Richardson et al. 2000
Diversity and Distributions 6:93-107

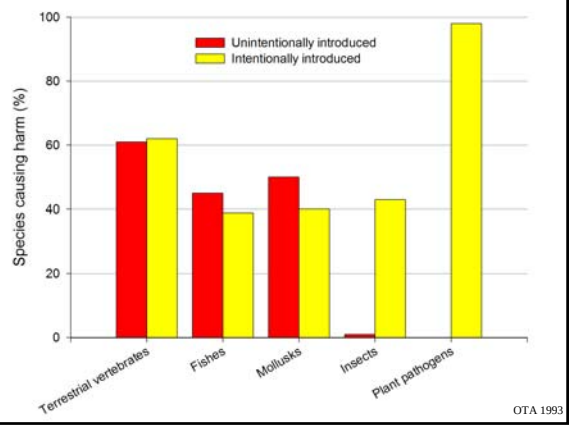
Introduction and establishment



Introduction
-accidental
-intentional

Propagule pressure
-abundance
-frequency

Dutch Trade Routes, ca. 1650. The Dutch were the greatest commercial nation of the seventeenth century.



OTA 1993

Invasion and Naturalization

Factors affecting:
Abiotic
-physical environment

Biotic
-resources
-natural enemies
-competition

-disturbance
-maturity

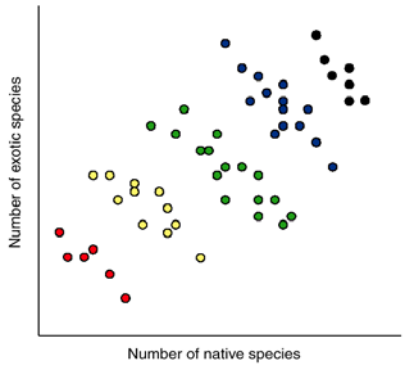
"Trying to raise a family, establish a career AND invade a planet? It's no wonder you feel stressed-out."

Hanging out the laundry

- NO definitive list of characters that define a good invasion strategy Kolar and Lodge 2001 TREE 16:199-204
  - What is important at one stage may not be important at another (e.g., introduction vs. naturalization)
- NO general predictor of community invasibility but see disturbance Lozon and MacIssac 1997 Envir. Rev 5:131-144
- NO intrinsic property – a match between a species and an ecosystem Shea and Chesson 2002 TREE 17:170-176

Ecological Impacts

- Extirpation of native species
- Changes to ecosystem structure
- Changes to ecosystem function
- Diseases/pathogens
- Hybridization



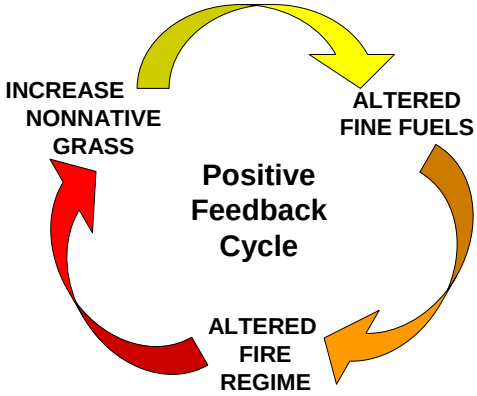
Shea and Chesson 2002

TRENDS in Ecology & Evolution

What now???

- Passengers or drivers
- Ecological trap?
  - Cost : benefit
- Management possibilities
- Good ideas gone bad

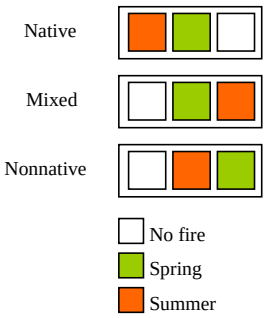
Ecological Drivers in Southwestern Grasslands



Research objectives

- Assess effects of disturbance regime on biotic communities in southwestern grasslands
- Quantify relationships among biotic communities before and after fire
- Assess the influence of *Eragrostis lehmanniana* on fire effects and community relationships

Experimental Design



3 community types
x 3 fire regimes
x 2 years
x 3 replicates

54, 1-ha plots

Response measures

Plants

herbaceous, woody, agave

25 1 m x 0.5 m quadrats

2 sampling events

Species richness

Biomass

Response measures

Arthropods

9 pitfall traps per plot

3 sampling events

Response measures

Small mammals

64 Sherman traps

5 trapping nights

3 sampling events

Species richness

Species abundance

Response measures

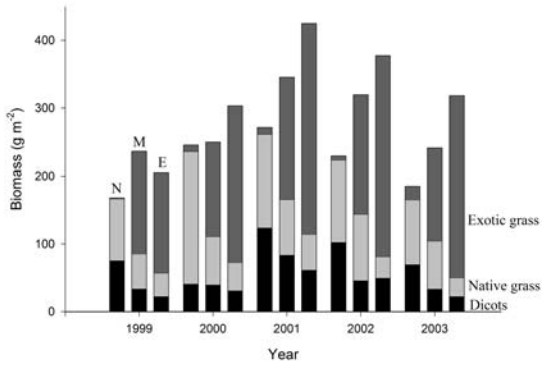
Birds

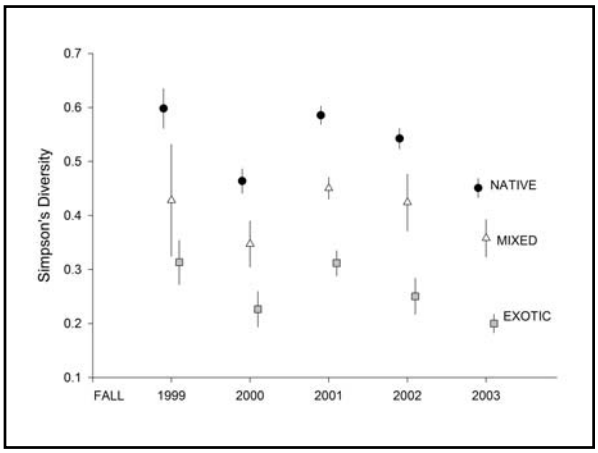
variable circular plots

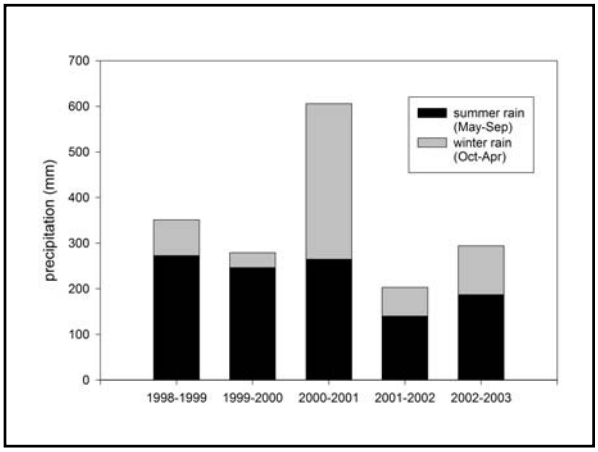
point counts April-October

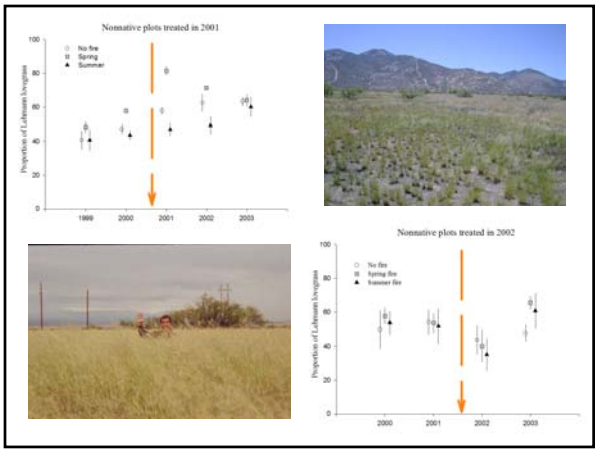
nest density

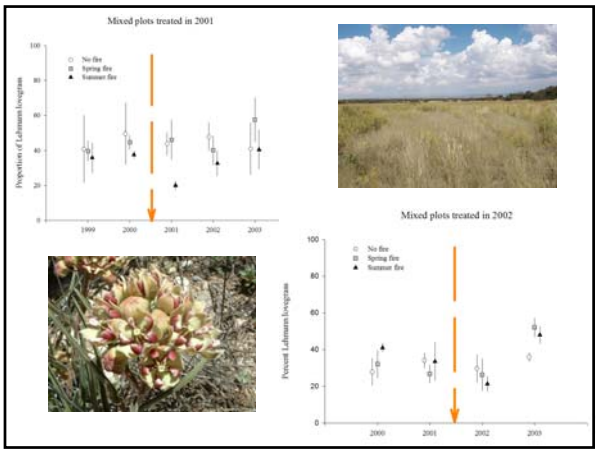
reproductive success

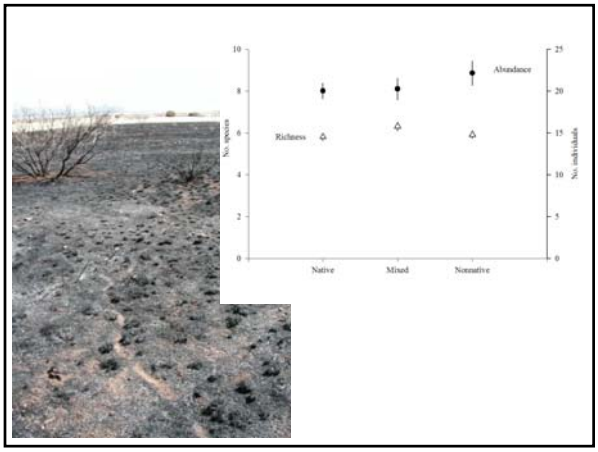


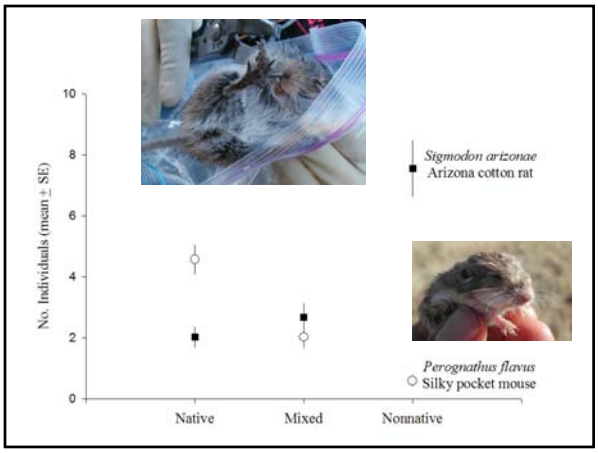

Simpson's Diversity
0.7
0.6
0.5
0.4
0.3
0.2
0.1
FALL
1999
2000
2001
2002
2003
NATIVE
MIXED
EXOTIC


precipitation (mm)
700
600
500
400
300
200
100
0
1998-1999
1999-2000
2000-2001
2001-2002
2002-2003
summer rain (May-Sep)
winter rain (Oct-Apr)


Nonnative plots treated in 2001
No fire
Spring
Summer
Nonnative plots treated in 2002
No fire
Spring fire
Summer fire


Mixed plots treated in 2001
No fire
Spring fire
Summer fire
Proportion of Lehmann lovegrass
1999
2000
2001
2002
2003
Mixed plots treated in 2002
Percent Lehmann lovegrass


Abundance
Richness
No. species
No. individuals
Native
Mixed
Nonnative


No. Individuals (mean ± SE)
Sigmodon arizonae
Arizona cotton rat
Perognathus flavus
Silky pocket mouse
Native
Mixed
Nonnative

Conclusions

- Plant communities were relatively stable over time
- Sites with greater proportion of Lehmann lovegrass tended to have fewer species
- Response of plant communities depended on conditions prior to and after fires
- There was no significant difference across treatments

Conclusions cont…

- Despite differences in plant communities, mammal richness and relative abundance was similar across a gradient of Lehmann lovegrass.
- Some species were more common on nonnative plots probably due to their preference of vegetation cover.
- Birds responded more to cover than vegetation type (data not shown)

What can you do?

- Educate yourself and others
- Local: Arizona Native Plant Society, Don't Plant a Pest, Desert Survivors, Weed whackers
- National: support legislation
- International: don't support importation of living biotic material