Ecological Correlates of Fountain Grass in Coastal Sage Scrub

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Fountain grass (*Pennisetum setaceum* (Forssk. Chiov.))

- Native to North Africa and the eastern Mediterranean region
- Naturalized or invasive in Hawaii, Arizona, Nevada, Australia and Southern Africa
- Horticultural introduction
- Perennial C₄ bunchgrass
  - Drought-tolerant, “warm-season”
Fountain Grass Problems

- Invades dry landscapes

- Alters fire cycles and microhabitats (Hawaii)

- Facilitates a conversion from dry forest to grassland (Hawaii) (Blackmore and Vitousek 2000)

- Interferes with recruitment of native species (Hawaii)

- No published information on fountain grass ecology in California
**Fountain Grass in California**

- First wild-land record from 1917 in Los Angeles
- Extensive stands exist on roadsides
- Localized escaped populations at undisturbed sites in coastal sage scrub (CSS), especially in post-fire areas
Research Goals

- Improve knowledge about areas susceptible to invasion by fountain grass
  - Where in CSS is it most likely to invade?
  - Examine physical and biological correlates

- Overall study goal: examine changes in communities with fountain grass invasion over several study years
Sites and Site Selection

- Experiment Replicated in 3 Regions
  - Santa Monica Mountains (SAMO)
  - Riverside County
  - Eastern San Diego

Selection of Sites
- >10m invasion
- Wild populations located in undisturbed CSS

(Riverside County site results not reported here)
(2010 Data not reported here)
Materials and Methods

- **3 transects per site**

- **Sampling**
  - Stratified random along transect at 2m intervals

- **2 plots of each cover class per transect**
  - **Cover classes of fountain grass:**
    - 0%
    - 1-33%
    - 33-66%
    - 66-100%

- **Data**
  - % cover of all species, rock, bare ground & litter
  - Site characteristics and soil samples
ANOVA Results: Santa Monica Mountains

Santa Monica Mountains Sites: Percent Cover of Native and Exotic Species in Plots of 4 Cover Classes of Fountain Grass

Santa Monica Mountains Sites: Richness of Native and Exotic Species in Plots of 4 Cover Classes of Fountain Grass
ANOVA Results:
San Diego County

San Diego Sites: Percent Cover of Native and Exotic Species in Plots of 4 Cover Classes of Fountain Grass

San Diego Sites: Richness of Native and Exotic Species in Plots of 4 Cover Classes of Fountain Grass
Regression Results

- Functional groups impacted differently
- Percent cover declines
  - Native annuals (SD + SAMO)
  - Perennial grasses (SAMO)
  - Perennial forbs (SD)
  - Exotic annuals (SD)
- Richness declines
  - Native annual and perennial grasses (SAMO)
Discussion

- Why are there declines in native and exotic cover as fountain grass increases?
  - Preemption of (collectively “space”):
    - Light, Water, Nutrients

- Why is there a decline in richness as fountain grass increases?
  - Change in type, frequency and characteristics of safe sites
  - This might change recruitment conditions for species
Regional Differences

- Why were results different in the two regions?

- Can we explain these results in terms of...
  - Biotic characteristics or community structure?
  - Physical or abiotic characteristics?
Regional Richness Differences: Functional Groups

SAMO
- 52 TOTAL SPECIES
- 5 EXOTIC FORB
- 4 EXOTIC GRASS
- 6 NATIVE FORB
- 32 NATIVE GRASS

SAN DIEGO
- 65 TOTAL SPECIES
- 10 EXOTIC FORB
- 8 EXOTIC GRASS
- 11 NATIVE FORB
- 31 NATIVE GRASS
- 5 NATIVE SHRUB
San Diego vs. Santa Monica Mountains

- San Diego- higher number of native species overall but similar native species richness average *per plot*
- San Diego- higher mean cover and richness of exotic species overall
- San Diego- similar richness of native and exotic species
- Santa Monica Mountains- higher ratio of native: exotic richness
Principal Components Analysis: Physical Characteristics

Eigenvectors

<table>
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<tr>
<th></th>
<th>PCA 1</th>
<th>PCA 2</th>
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<tbody>
<tr>
<td>Bareground</td>
<td>-0.22157</td>
<td>-0.60132</td>
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<td>Rock</td>
<td>0.58153</td>
<td>0.03149</td>
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<td>Litter</td>
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<td>WC % In soil</td>
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<td>% Rock by Weight In soil</td>
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<tr>
<td>Aspect%</td>
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</tbody>
</table>

Regions significantly split by variables making up PC1 (one-way AOV, p<0.01)
Conclusions

- Declines and differences noted, especially comparing low and high cover classes.
- Regional differences may explain different community responses.
  - Higher Water Content = non-limiting resource?
  - Further investigation necessary.
- There is no “before” here.
  - Results must be considered correlation.
  - Longer-term data might reveal whether results are due to fountain grass impacts.
Broader Implications

- Fountain grass can invade intact coastal sage scrub
- Fountain grass can reach 100% cover
- All invasive populations were found on southwest-facing slopes
Thanks to...

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  - UCR Botany & Plant Sciences Department

Natives fight back!
Initial 2010 Results

- Patterns similar

- Recruitment seen into 0% cover areas
  - Formerly outside the invasion “boundary”

- Abiotic characteristics - at Mullholland
  - No differences in soil temperature or moisture correlated with cover of fountain grass