Carrizo Plain Ecosystem Project (CPEP): 2014 and Beyond
CPEP A Collaborative Project
CPEP A Collaborative Project

- Bureau of Land Management: K. Sharum, J. Hurl, D. Wreden, L. Saslaw, J. Kelley
- The Nature Conservancy: T. Maloney, S. Butterfield
- California Department of Fish & Wildlife: B. Stafford, S. Osborn, J. Garcia, E. Burkett
- Funding & Support: NSF, USDA, USFWS, TNC, BLM, UC Berkeley, University of Alaska, University of Colorado, Boulder
Today’s Presentation

1. CPEP Overview
2. CPEP General Results
3. CPEP 2014 Preliminary Data
4. What’s New: Climate Change
Giant kangaroo rat distribution

Carrizo Plain Study Area (112 km$^2$)
The Carrizo Plain Ecosystem Project

• Initiated in 2006
• Examines the relationships between cattle, giant kangaroo rats, plants, and other species in the Carrizo Plain using replicated exclosures
• 10 cattle exclosures in the annually-grazed Center Well pasture
• 20 kangaroo rat exclosures in the Center Well and Swain (ungrazed) pastures
Goal #1:
To quantify the effects of the giant kangaroo rat on other species in the Carrizo

*Dipodomys ingens*
Goal #2:
To quantify the effect of cattle grazing on giant kangaroo rats and other vertebrates
What We Survey

- Plant and soil sampling
- Giant kangaroo rats
- San Joaquin antelope squirrels (SJAS)
- Birds (2007-2012)
- Invertebrates
- Reptiles
  - Blunt-nosed leopard lizards (BNLL)
- Spotlight surveys
- Kit fox activity, diet, den locations
- Cattle grazing intensity
Study Plots ($n = 30$, 2 ha each)
Study Design

- Cattle exclosure
  - Buffer zone around trapping grid
  - Trapping grid

- Control (grazed) plot
  - Rodent exclosure
  - Control plant sampling area

Distance:
- 60 m
- 140 m
Study Design
Non-engineering effects
Seed predation
Herbivory
Being preyed upon, supporting predators
Competition with other granivores and herbivores

Engineering effects
Subterranean habitat creation
Altered soil chemistry
Disturbance of soil and plants
Removal of plant thatch
Buffer zone around trapping grid
Rodent exclosure
Control plant sampling area
Cattle exclosure
Control (grazed) plot
Trapping grid
Large-scale
Small-scale
1) Large plot (2 ha) surveys, Structural Equation Modeling (SEM)

Used SEM to estimate relative importance of burrow density (engineering), kangaroo rat density (non-engineering), and other site characteristics (soil, primary productivity) on community structure.
Approach #2: small-scale, experimental (plants and invertebrates only)

2) Kangaroo rat exclosures (n = 20)

Kangaroo rat presence = proxy for non-engineering effects
Burrow presence = proxy for engineering effects
Results

• Large Scale: Engineering effects were stronger than non-engineering effects and other site factors, and net effects were positive

• Small Scale:
  • Engineering had a stronger effects on plants than non-engineering activities
  • Non-engineering activities had a stronger effects on invertebrates than engineering
    • Beetles are 50% more abundant with GKR
GKR effects on grasses
GKR prefer to eat large seeds

- Engineering will favor red brome
- Non-engineering effects will favor bunchgrass
Native bunchgrass (*Poa*) is more abundant on burrows where GKR are present.
Invasive brome grass is more abundant on burrows where GKR are absent.
Krat engineering creates foci of invasion, but their foraging keeps invasive grass from competitively excluding natives.

Prediction:
- Engineering will favor red brome
- Non-engineering effects will favor bunchgrass

[Image of grass]
Grazing effects on vertebrates
Grazing may benefit GKR in wet years
Grazing may be detrimental to squirrels in some years.

<table>
<thead>
<tr>
<th>Year</th>
<th>Difference in SJAS density (with - without grazing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>0</td>
</tr>
<tr>
<td>2008</td>
<td>-12</td>
</tr>
<tr>
<td>2009</td>
<td>-10</td>
</tr>
<tr>
<td>2010</td>
<td>-8</td>
</tr>
<tr>
<td>2011</td>
<td>-4</td>
</tr>
</tbody>
</table>
Grazing may be detrimental to lizards in some years.
2014 Results

• Not all in
• 200/67 *Dipodomys ingens* (2,992/1,394 max)
• 67/34 *Ammospermophilus nelsoni* (330/296 max)
• Density:
  – GKR: Lowest ever recorded
  – SJAS: Second lowest ever recorded
• Grazed verses ungrazed plots (3 years)
  – No significant differences for GKR or SJAS
Estimates in Center Well grazed plots, Center Well ungrazed plots, and Swain ungrazed plots, from April 2008 to August 2014. Standard error bars are shown ($n = 10$ grids per treatment).
2014 Results: GKR v. SJAS

Apparent survival

Overwinter
• GKR: Lowest ever recorded
• SJAS: Average level

Summer
• GKR: Lowest ever recorded in the Center Well pasture, mid range for Swain

Reproduction
• GKR: Second lowest on record
• SJAS: Lowest on record
Goal #3:
To assess the potential impacts of climate change on the distribution, abundance, dynamics and interactions of native and invasive species in the Carrizo Plain National Monument
Study Design
Rain shelters and irrigation plots are being added to our pre-existing plots.
Precipitation will directly affect plant growth and indirectly affect plants by affecting kangaroo rat density.

GKR density will affect plant biomass and competition via trophic interactions such as clipping, seed caching, and seed consumption.

GKR will also affect plants via biopedturbation (soil disturbance), which will alter soil nutrients, aeration, and infiltration.
Carrizo Plain Ecosystem Project