San Joaquin Kit Fox Demography, Ecology, and Conservation in the Northern Carrizo Plains

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Background

- **Topaz Solar Farm**
  - 550-megawatts
  - 3,510 acres project footprint
  - Approximately 18,000 acres of mitigation/settlement land

- **California Valley Solar Ranch**
  - 250-megawatts
  - 1,500 acres project footprint
  - Over 12,000 acres of mitigation/settlement land

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Kit Fox Habitat Suitability

Remaining habitat
Suitability
- Moderate
- High

Kilometers
Topaz Mitigation Land

- CDFW took fee title and will manage
- Habitat Mitigation and Monitoring Plan (HMMP)
- Habitat management
  - Wildlife friendly fencing
  - Keep veg structure low (cattle grazing)
  - Restore shrubs
  - Veg and prey monitoring
Kit Fox Study

• **Goals:**
  – Examine response of kit foxes to habitat management strategies, particularly grazing
  – Collect basic demographic and ecological data

• **Specific objectives:**
  1. Collect data on kit fox habitat use
  2. Collect data on demography (survival and reproduction) and ecology (movements, den use, food habits)
  3. Use information to develop/refine regional and site-specific conservation strategies
Methods

- GPS collars w/ VHF transmitters and mortality sensors
- Weekly night monitoring and day sourcing
  - Monitor survival
  - Remotely download locations
  - Locate dens
- Suspected natal dens monitored for pups
- Scats collected for food habit analysis
Results

• 10 foxes trapped and collared in January on Klock property
  – 6 adult males and 4 adult females
• Foxes monitored weekly from January to June
• Two mortalities
  – Female and male, both suspected bobcat predations
• Seven foxes recaptured in August, 1 missing
• One animal entrapped in a hole, but rescued
• No evidence of successful reproduction
• 28 dens located
• 3,356 night locations (37-542/fox)
• Almost 200 scats collected - analysis in progress
### Fate of Collared Foxes

<table>
<thead>
<tr>
<th>Fox</th>
<th>Collared</th>
<th>Locations</th>
<th>Fate</th>
</tr>
</thead>
<tbody>
<tr>
<td>M 6695</td>
<td>1/3/13</td>
<td>391</td>
<td>Collar removed 8/6/13</td>
</tr>
<tr>
<td>F 6610</td>
<td>1/4/13</td>
<td>395</td>
<td>Collar removed 8/6/13</td>
</tr>
<tr>
<td>F 6612</td>
<td>1/5/13</td>
<td>483</td>
<td>Collar removed 8/7/13</td>
</tr>
<tr>
<td>M 6611</td>
<td>1/5/13</td>
<td>542</td>
<td>Collar removed 8/7/13</td>
</tr>
<tr>
<td>M 6613</td>
<td>1/5/13</td>
<td>283</td>
<td>Mortality 4/17/13 - bobcat</td>
</tr>
<tr>
<td>M 6696</td>
<td>1/12/13</td>
<td>408</td>
<td>Collar removed 8/14/13</td>
</tr>
<tr>
<td>F 6698</td>
<td>1/13/13</td>
<td>399</td>
<td>Collar removed 8/7/13</td>
</tr>
<tr>
<td>M 6697</td>
<td>1/14/13</td>
<td>356</td>
<td>Collar replaced 8/24/13 with VHF collar</td>
</tr>
<tr>
<td>F 6699</td>
<td>1/15/13</td>
<td>77</td>
<td>Mortality 2/14/13 - bobcat</td>
</tr>
<tr>
<td>M 6701</td>
<td>1/15/13</td>
<td>37</td>
<td>Last location 1/30/13 – not recaptured</td>
</tr>
</tbody>
</table>
## Home Range Size
(100% MCP - Sq Km)

<table>
<thead>
<tr>
<th>Study Site</th>
<th>All</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elk Hills (Koopman 1995)</td>
<td>3.5</td>
<td>5.7</td>
<td>2.2</td>
</tr>
<tr>
<td>Elk Hills (Zoellick et al. 2002)</td>
<td>4.6</td>
<td>5.2</td>
<td>4.2</td>
</tr>
<tr>
<td>Carrizo (White and Ralls 1993)</td>
<td>11.6</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Topaz Mitigation Lands</td>
<td>10.0</td>
<td>12.9</td>
<td>6.4</td>
</tr>
<tr>
<td>w/ “Augie”</td>
<td>11.7</td>
<td>15.2</td>
<td>-</td>
</tr>
</tbody>
</table>

*Topaz Mitigation Lands (w/o Augie)*

<table>
<thead>
<tr>
<th>Study Site</th>
<th>Size</th>
<th>MCP Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lokern (Spiegel and Bradbury 1992)</td>
<td>6.4 sq km</td>
<td>95% MCP</td>
</tr>
<tr>
<td>Lokern (Nelson 2005)</td>
<td>5.9 sq km</td>
<td>95% fixed kernel</td>
</tr>
</tbody>
</table>
Food Items in Scats  
(n = 100)

• Rodents
  – Ground squirrels
  – Pocket mice
  – Pocket gophers
  – Kangaroo rats

• Birds

• Snakes

• Vegetation
  – Olive pits
  – Pistachios

• Invertebrates
  – Beetles
  – Jerusalem crickets
  – Scorpions
  – Grasshoppers

• Anthropogenic
  – Food wrappers
  – String
  – Chew toys
Food Item Use

<table>
<thead>
<tr>
<th>Food Items</th>
<th>Frequency of Occurrence (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rodent</td>
<td>50</td>
</tr>
<tr>
<td>Bird</td>
<td>20</td>
</tr>
<tr>
<td>Snake</td>
<td>5</td>
</tr>
<tr>
<td>Invert</td>
<td>80</td>
</tr>
<tr>
<td>Anthro</td>
<td>10</td>
</tr>
<tr>
<td>Veg</td>
<td>10</td>
</tr>
</tbody>
</table>
We conclude that kangaroo rats constitute the “staff of life” of the kit fox in such localities.

Grinnell, Dixon, & Linsdale, 1937
Fur-bearing Mammals of California, p. 417
Conclusions to Date

• GPS collars w/ VHF transmitters and mortality sensors performed well yielding abundant data
• Survival and reproduction difficult to quantify w/o multi-year data
• Den availability seems to be high
• Home ranges somewhat larger compared to home ranges in core areas
• High use of foods other than kangaroo rats
• Reduced repro success and larger HRs may reflect lower habitat quality, low rainfall, or both
• Foxes exhibiting some use of Topaz solar site
Future efforts

• Complete data analyses
• Complete report/manuscript
• GPS Collar re-deployment?
  – Would be extremely informative
  – Funding dependent
• Kit fox monitoring on Topaz site
  – 3 foxes with VHF collars from ESRP
  – 10 collars purchased by Althouse&Meade
• Post-construction monitoring on both Topaz and CVSR sites
• Ecosystem monitoring
Acknowledgements

Funding
• E Monitor LLC
• CA DFW

Folks
• Tory Westall
• Erica Kelly
• Abby Gwinn
• Bob Stafford
• Dave Hacker
• MidAmerican
• Christine Van Horn Job
• Jamie Miller
• Larry Saslaw
• Brian Boroski