Impacts of cattle grazing: a comparison of two properties on Sonoma Mountain

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Background

- Land managers make decisions based on a variety of objectives, including abiotic variables and habitat quality for target species from a wide array of taxa
- Domestic grazers can be used as a management tool to target invasive plants and encourage the growth of native plant populations (1,2)

- Grazing may result in cascading impacts on small mammal and herpetofauna communities; impacts may vary with species and grazing intensity (3,4)
- Examining how cattle grazing impacts abiotic variables and taxa in specific habitats can influence management decisions in protected lands
- We targeted grasslands in oak savannahs due to the importance and widespread practice of cattle grazing in these habitats in Sonoma County

Methods

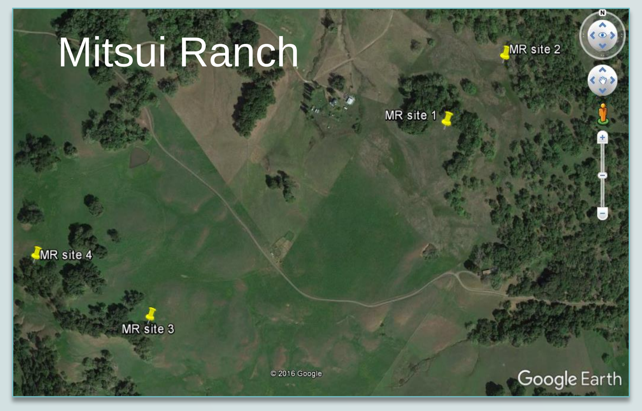
Mitsui Ranch:

- Managed by Sonoma Mountain Ranch Preservation Foundation
- Cattle grazing since mid-1850s
- Holistic planned management grazing regime, managed in partnership with Sonoma Mountain Institute, since 2014

Fairfield Osborn Preserve:

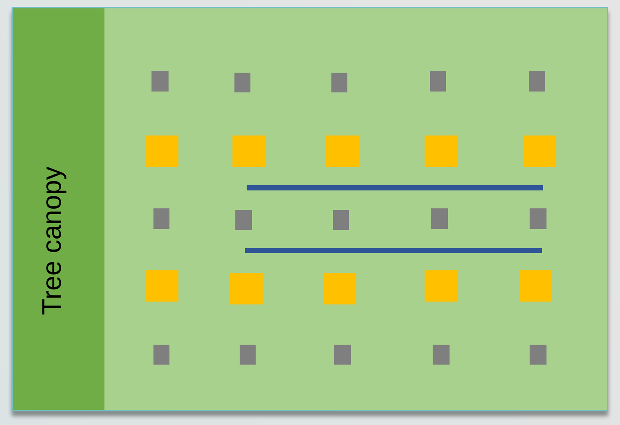
- Managed by Center for Environmental Inquiry, SSU
- Cattle grazing from 1890s-1950s, horse grazing from 1950s-1970
- Domestic grazers excluded from property since 1970

Four sites at each preserve:



- Grassland adjacent to tree canopy
- Elevation 2000-2300ft
- Goulding clay loam soil
- Not subject to prescribed burns

Site setup



Identifying and measuring small mammal captured in Sherman trap

Measuring soil moisture and penetration resistance along transect

- 3” Sherman traps:
  - 3 trap nights at each preserve from March-April 2017
- 2’x2’ Coverboards:
  - Installed December 2016, 9 weekly surveys from February-April 2017
- 30m transects:
  - Vegetation height and thatch depth measured every 1m
  - Soil moisture to 10cm and penetration resistance to 30cm measured every 2m
- Analysis
  - Block design linear mixed models using JMP Pro 13

Results

Sierran treefrog (*Pseudacris sierra*)

Ring-necked snake (*Diadophis punctatus*)

Western fence lizard (*Sceloporus occidentalis*)

Western skink (*Pleistodon skiltonianus*)

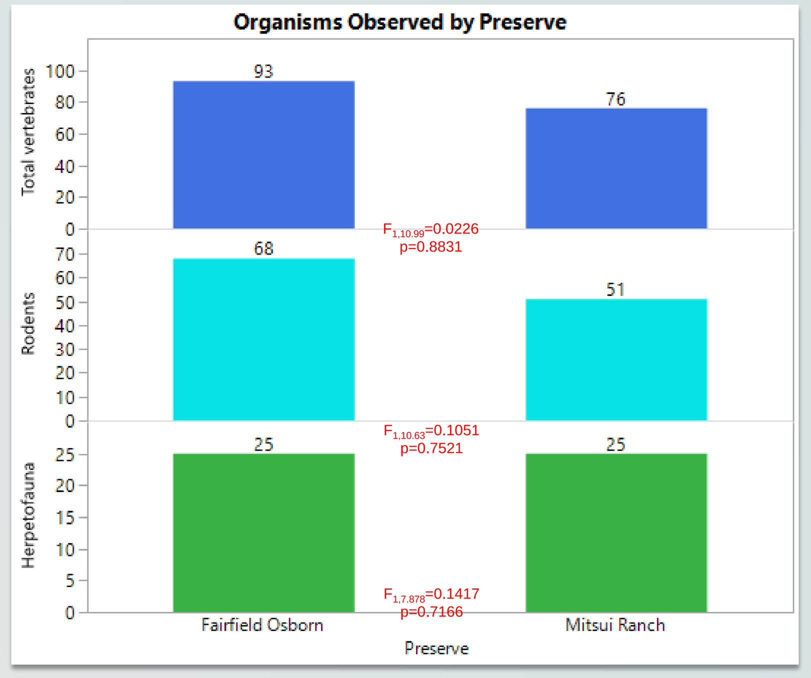
Harvest mouse (*Reithrodontomys megalotis*)

Western toad (*Anaxyrus boreas*)

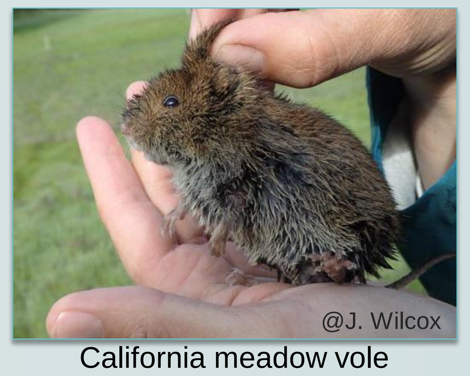
Yellow-eyed ensatina (*Ensatina eschscholtzii eschscholtzii*)

Vertebrate Observations:

- 23 amphibians, 27 lizards and snakes, and 119 rodents observed, for a total of 169 vertebrates
- When controlled for site and date, there was **no significant difference** in number of observations between preserves of herpetofauna ($F_{1,7.878}$=0.1417, p=0.7166), rodents ($F_{1,10.63}$=0.1051, p=0.7521), or total vertebrates ($F_{1,10.99}$=0.0226, p=0.8831)



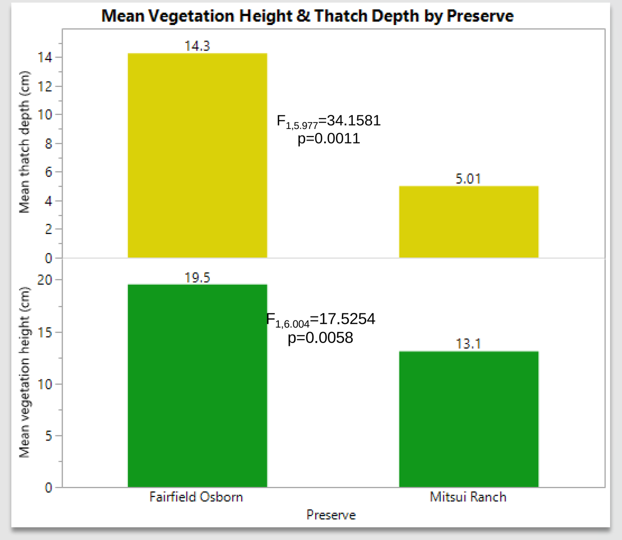
Deer mouse (*Peromyscus maniculatus*)



California meadow vole (*Microtus californicus*)

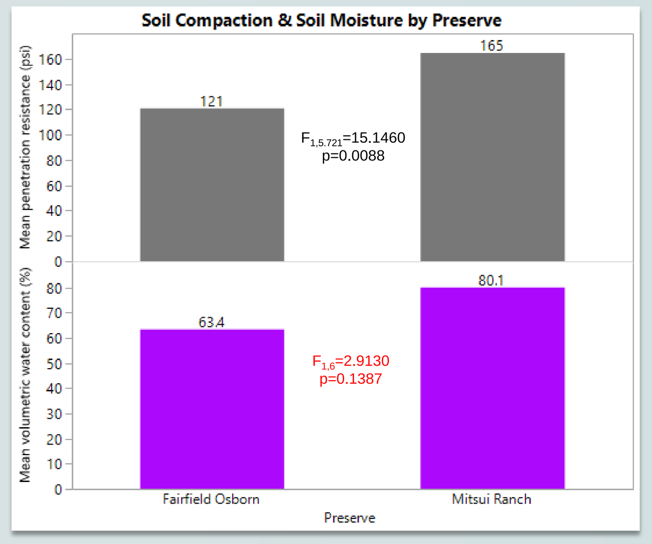
Above-ground habitat structure:

- When controlled for site and transect, vegetation height ($F_{1,6.004}$=17.5254, p=0.0058) and thatch depth ($F_{1,5.977}$=34.1581, p=0.0011) **were significantly different** between preserves. Vegetation was taller and thatch was deeper at Fairfield Osborn compared with Mitsui Ranch (Student’s t)



Below-ground habitat structure:

- When controlled for site and transect, **soil penetration resistance was significantly different** between preserves ($F_{1,5.721}$=15.1460, p=0.0088). Penetration resistance was greater at Mitsui Ranch compared with Fairfield Osborn (Student’s t)
- When controlled for site and transect, there was **no significant difference in soil moisture** between preserves ($F_{1,6}$=2.9130, p=0.1387)



Discussion

- Cattle grazing decreased vegetation height and thatch depth, thereby decreasing cover that can conceal ground-dwelling vertebrates in grassland habitats
- The long history of cattle grazing at Mitsui Ranch has resulted in increased soil compaction, which may impact burrow development and aspects of hydrology
- Despite these effects on habitat structure, the presence of domestic grazers did not impact the observation rate of ground-dwelling vertebrates at grassland sites from February to April

Future research

- Increasing the scope of this pilot study to include:
  - Properties where traditional and/or high-intensity grazing is practiced
  - Additional study sites to increase our ability to draw conclusions
- A longer study taking place throughout all seasons would allow us to examine potential phenological impacts on habitat structure and vertebrate populations
- An examination of predatory snakes and birds, including population dynamics and diet, might demonstrate that changing habitat structure impacts trophic relationships

- These soil measurements provide a baseline to examine whether Mitsui Ranch’s recent change from a traditional calf-cow grazing regime to holistic planned management grazing will mitigate soil compaction

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