Estimating forage loss from California ground squirrels in central California rangelands

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Rangeland damage

- Ground squirrels cause a variety of damage
  - removal of forage
  - broken legs

Rangeland damage

- Ground squirrels cause a variety of damage
  - significant erosion
  - damage to pond dams

Damage estimates

- Grinell and Dixon (1918)

  200 GS = 1 steer

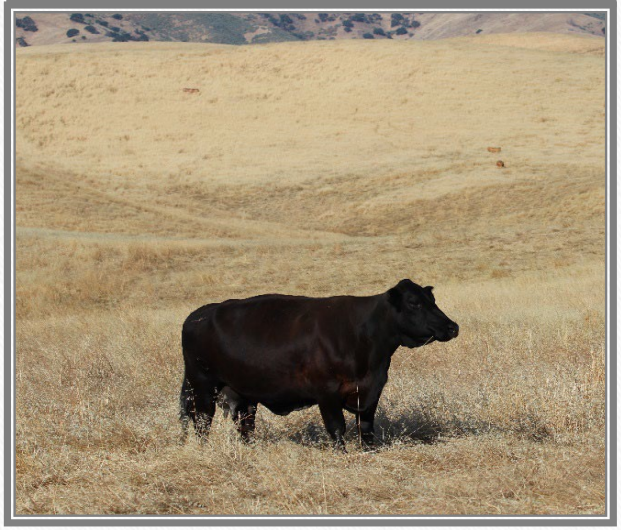
- Fitch and Bentley (1949)

  6 male GS decreased potential forage yield by 529 lbs of forage loss/0.5 acre

- Howard et al. (1959)

  GS control = 33 lb increase in gain/heifer

- Data limited and vastly outdated

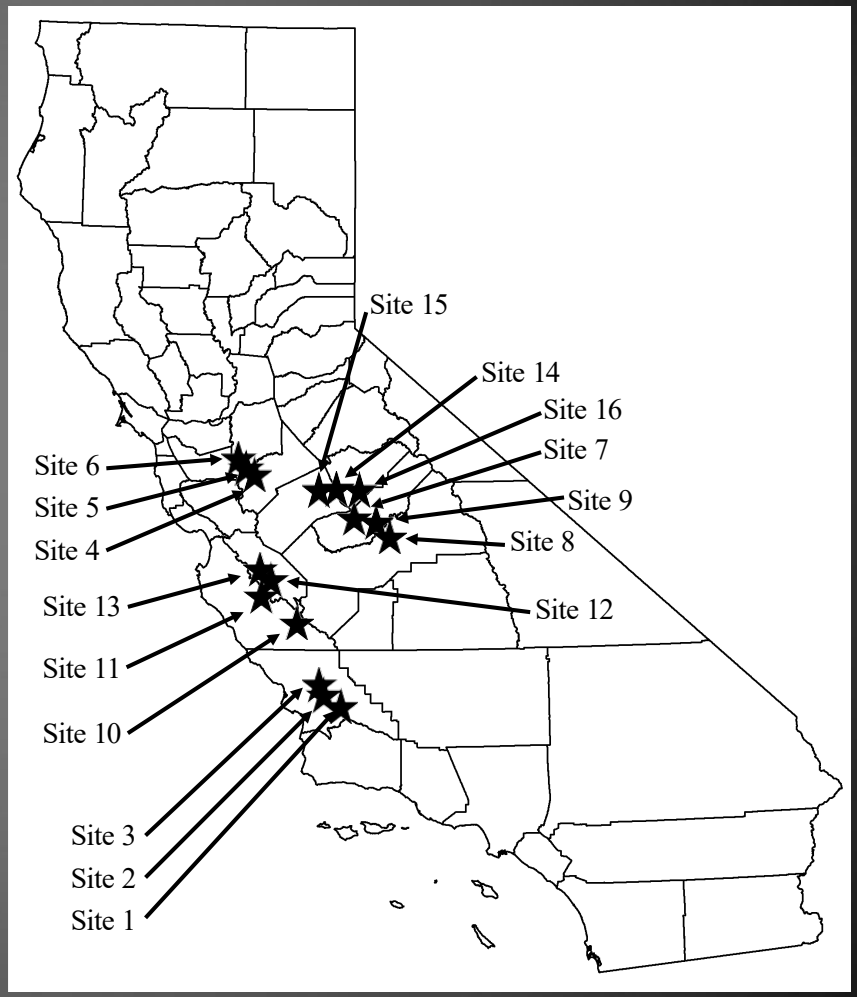


Objective

Determine forage loss based on ground squirrel density across various geographic areas in CA

Study design—GS counts

- Identified 16 field sites across 5 regions: Hollister, Modesto, Mariposa/Merced, Paso Robles, and Fresno
- Each plot = 1 acre, 4 plots/site
- Include a range of densities (0 to 30 GS/acre
- Monitoring via GS counts, 3 days, AM/PM, 30 total counts



Study design—GS counts

- Counts initiated following GS young emergence
- Sampling generally occurring within 4-6 weeks (May-early June)
- Conducted in 2019 and 2020

Study design—Standing crop (forage)

- Used comparative yield to estimate standing crop (forage)
- We collected 100 samples/plot

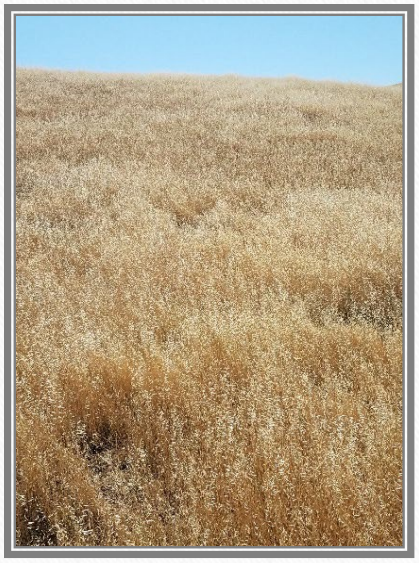
Analytical approach

- We compared ground squirrel abundance, grazing intensity, precipitation, and site to amount of existing forage at each site
- Rainfall was recorded at nearest weather station
- Grazing intensity determined by calculating animal unit months (AUMs)

Results—Raw numbers

- GS counts hit targets:
  - Minimal = 0.3 (target = 0–1)
  - Low = 4.9 (target = 2–6)
  - Medium = 10.7 (target = 7–15)
  - High = 17.1 (target >15)
- Grazing intensity varied:
  - 0.37–10.53 AUMs/ha
  - **0.15 – 4.26 AUMs/acre**

Results---- Raw numbers



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- Grazing intensity varied:
  - 0.37–10.53 AUMs/ha
  - **0.15 – 4.26 AUMs/acre**
- Forage biomass:
  - 2019 = 1,381 kg/ha **(1,232 lbs/ac)**
  - 2020 = 1,198 kg/ha **(1,069 lbs/ac)**
- Precipitation varied:
  - 2019 = 49 cm **(19 in)**
  - 2020 = 28 cm **(11 in)**

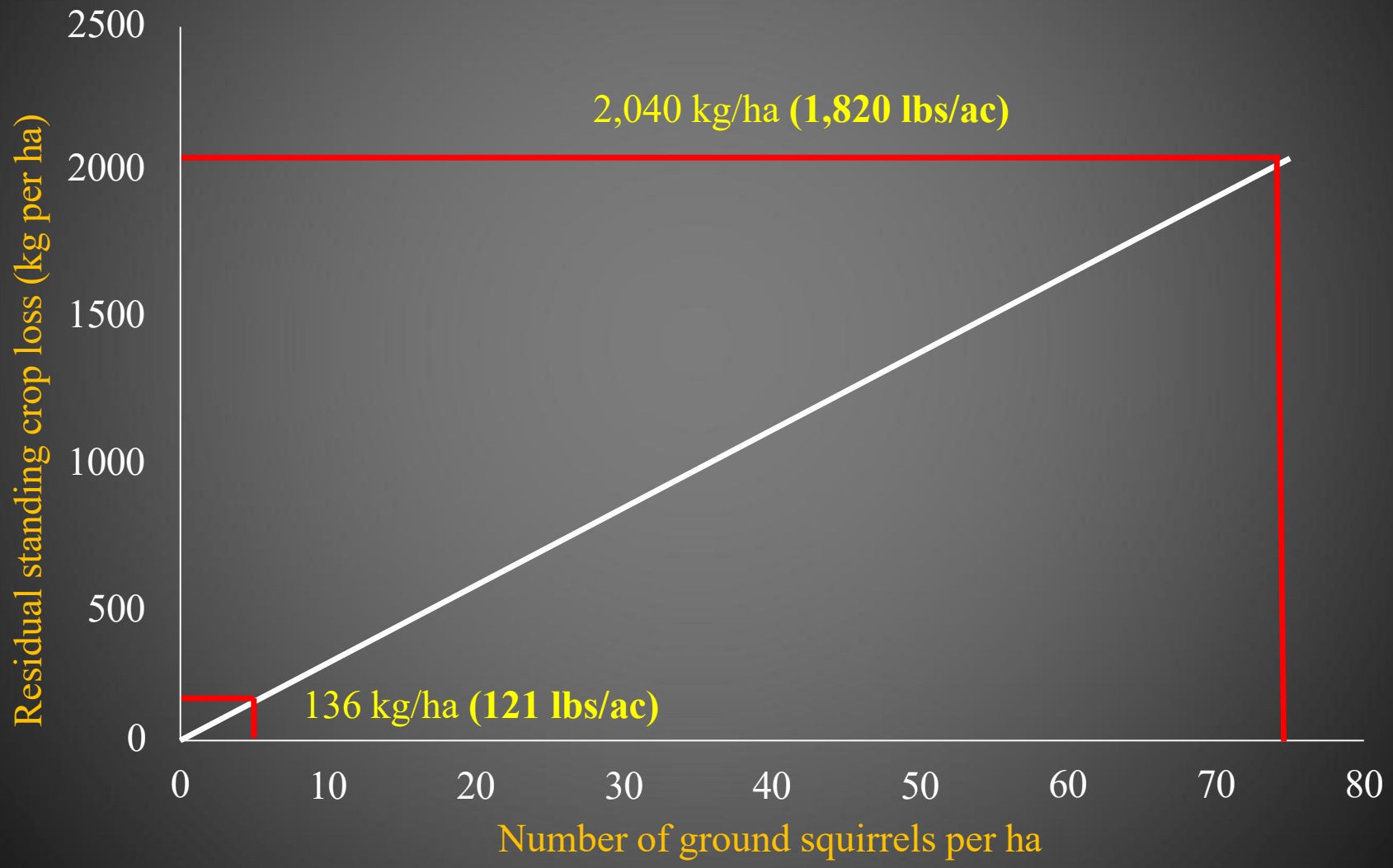
Results

Site, rainfall, and ground squirrel abundance affected the amount of forage:

Interpretation

- Each additional ground squirrel = 27.2 kg/ha **(24.3 lbs/ac)** loss of forage
- Similar to reassessment of Fitch and Bentley's (1949) study:
  - 23.7 kg/ha **(21.1 lbs/ac)**

Forage Loss


2,040 kg/ha (1,820 lbs/ac)
136 kg/ha (121 lbs/ac)
Residual standing crop loss (kg per ha)
2500
2000
1500
1000
500
0
0
10
20
30
40
50
60
70
80
Number of ground squirrels per ha

Interpretation

- Each additional ground squirrel = 27.2 kg/ha **(24.3 lbs/ac)** loss of forage
  - Cow/calf pair requires 425 kg/month **(937 pounds/month)** of forage, so losses can be substantial, depending on squirrel density
  - Estimates of damage conservative: do not include regrowth, consumption beyond plots, or consumption after study season

Interpretation

- Each additional 1 cm precip =
  - 16.6 kg/ha forage or
  - **1 in precip = 37.6 pounds/acre**
- Forage losses were not compounded by dry years
- However, less forage available during dry years makes forage losses from ground squirrels more acute

Management Implications

Ground squirrel damage is substantial at moderate to high densities

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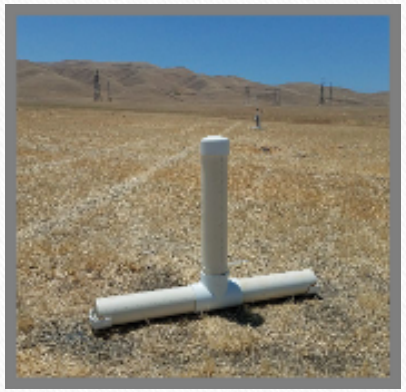
- Ground squirrel damage is substantial at moderate to high densities
- Have not considered other damage:
  - Undermining infrastructure
  - Hill slumping and erosion
  - Tripping hazard

Management Implications

- Ground squirrels are ecosystem engineers
  – balance not eradication



Future Research

- **Quantify other forms of damage to rangelands.**
- **Estimate ground squirrel management costs.**
- **This collective information would provide science- and economic-based approach to guiding ground squirrel management in California rangelands.**