Prescribed Goat Grazing for Wildland Management

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Presenters

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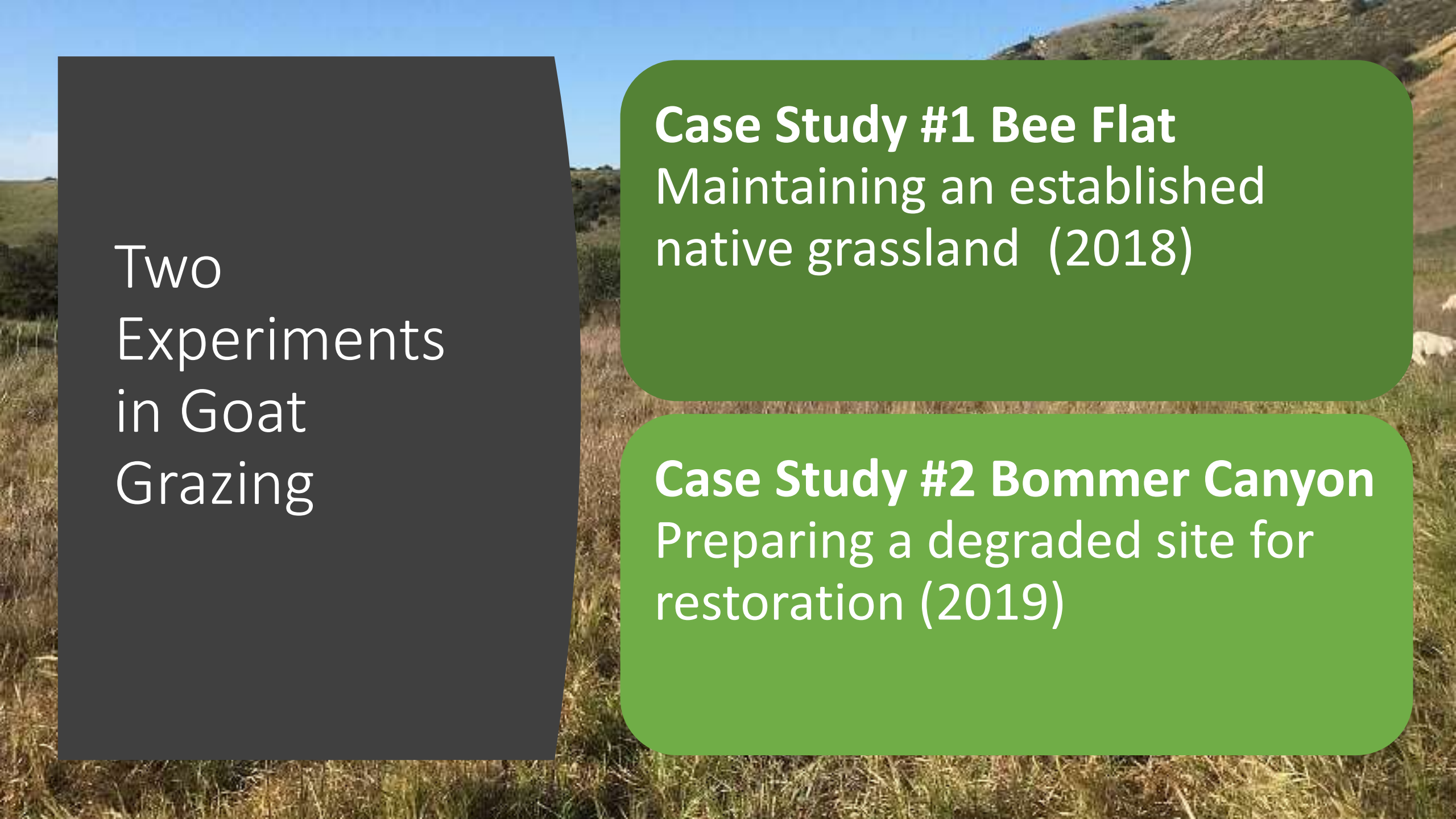


Two Experiments in Goat Grazing

Case Study #1 Bee Flat
Maintaining an established native grassland (2018)

Case Study #2 Bommer Canyon
Preparing a degraded site for restoration (2019)

Case Study #1: Bee Flat Native Grasslands

Phase 1

Phase 2

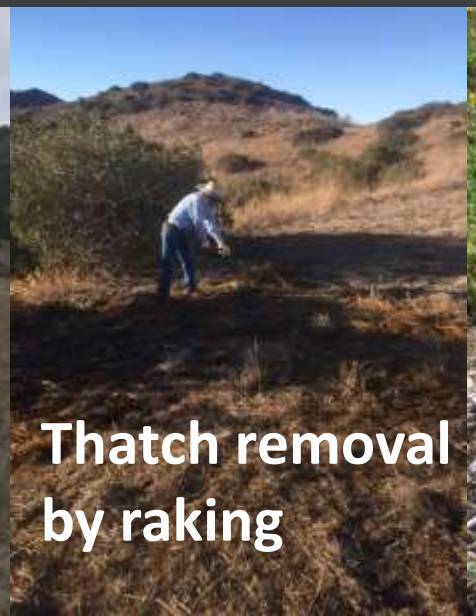
Annual grass re-invasion ?

Year 1 | Year 3 | Year 5

Importance of Grazing to Maintain Grasslands

- Periodic disturbance maintains biological diversity
- California Native Grasslands: hybrid ecosystem of natives and non-natives
- Proper timing, duration, and frequency of grazing may favor natives
- Grazing is one tool for breaking Thatch→Annual Grass→Thatch cycle


Thatch removal by grazing


Thatch removal by raking


Annual grass emerging from windrow


Thatched vs. De-thatched

Why Use Goats to Graze Invasive Plants?

- Widely available (often used for fire fuel reduction)
- Easy to transport, set up, and manage
- Grazing easily constrained with light-weight, electric mesh
- Hardy, agile, and effective on steep slopes
- Versatile in diet
- Charismatic (public likes goats!)

Versatile Foragers: Goat Diet at Two Study Sites

Artichoke thistle

Black mustard

Ripgut brome

Wild oats

Wild radish

Protective Fencing Prevents Consumption of Desired Plants

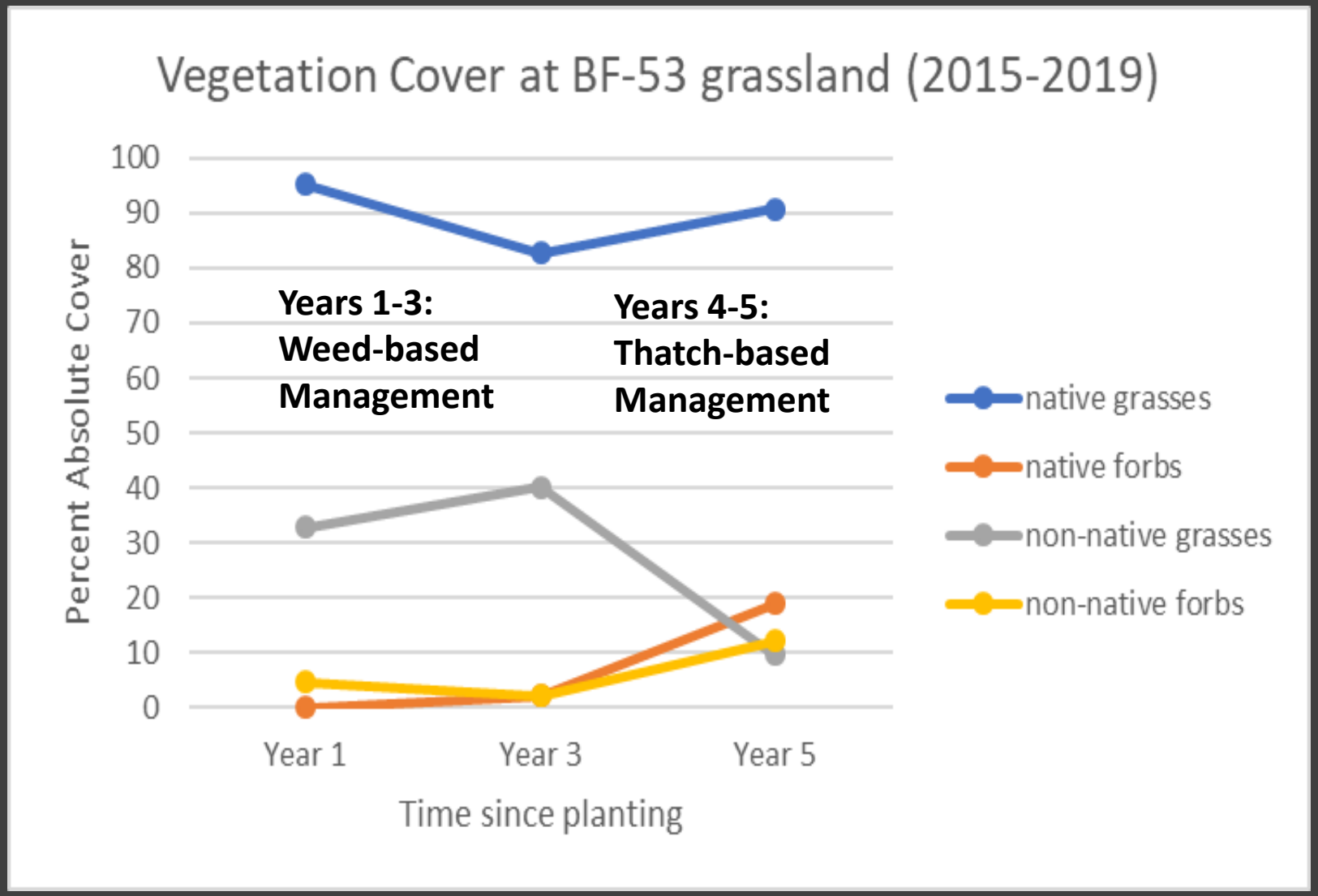
Operations

Timing of Goat Grazing

- Mid-spring optimal: Annual grasses green, flowering, and palatable. Native bunchgrasses still dormant, less appealing to goats.
- Grazing too early, plants re-sprout. Grazing too late, miss destroying flower heads.
- Long duration → overgrazing may result
- Fall optimal for invasive forb biomass removal

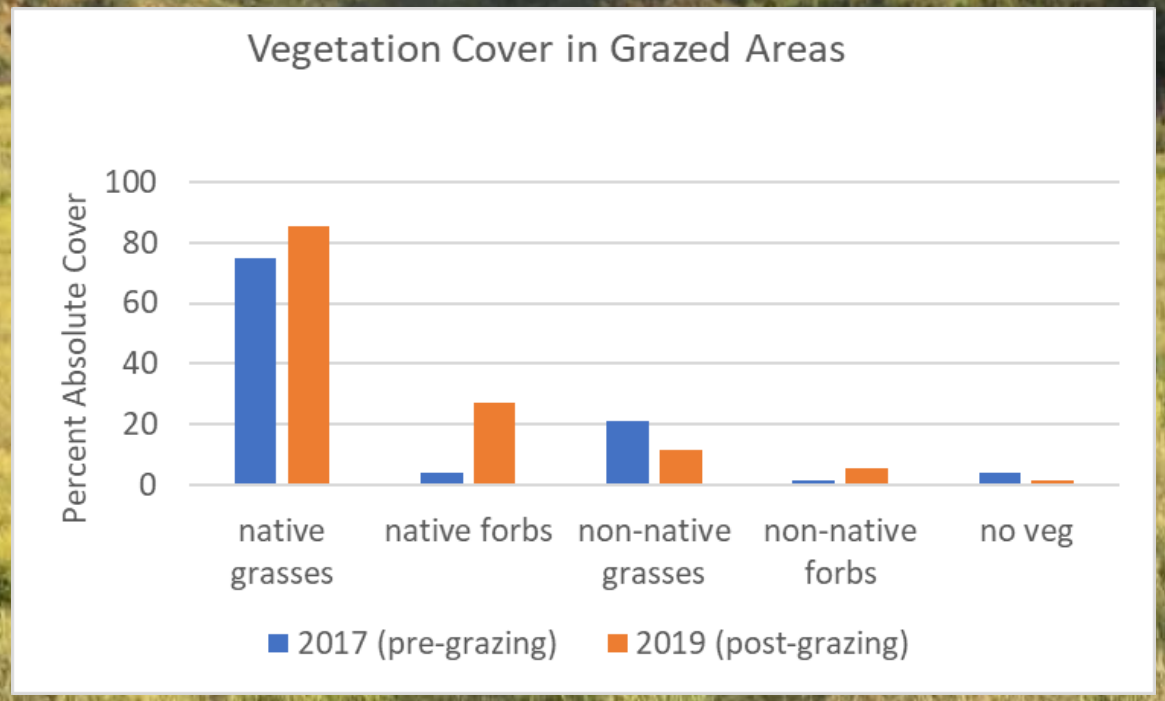
Grazing at Bee Flat
April 20-30, 2018

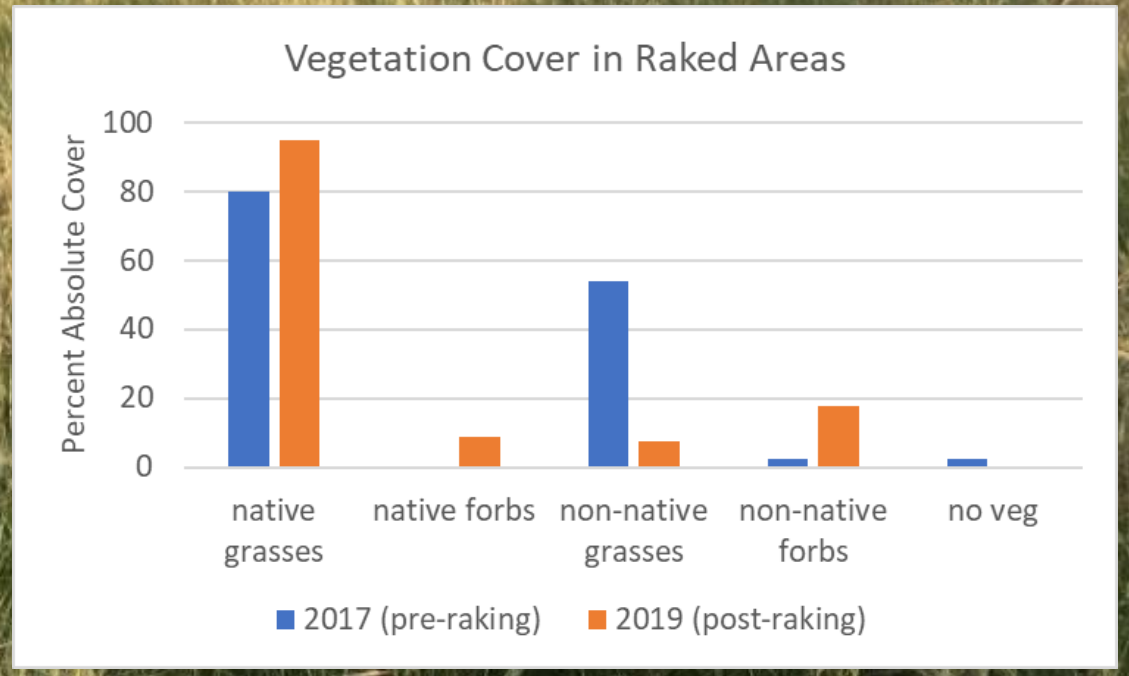
IRC Long-term Monitoring Transects



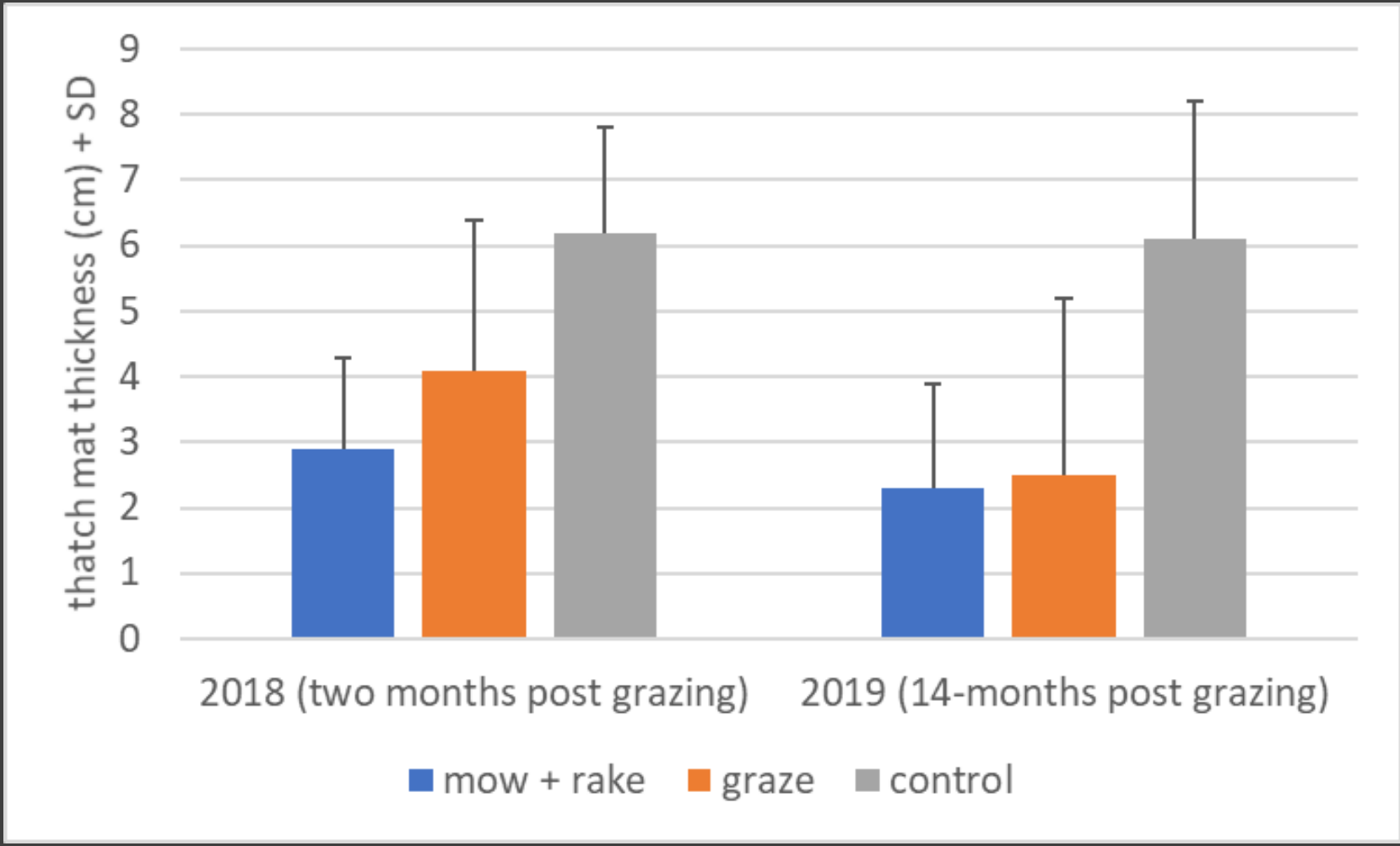
- Three 50-meter transects sampled every two years
- Half sample points grazed in April 2018
- Half sample points raked in August 2018

Change in Vegetation Cover: Grazed vs. Raked





UCI-CEB Study Plots: Thatch Thickness



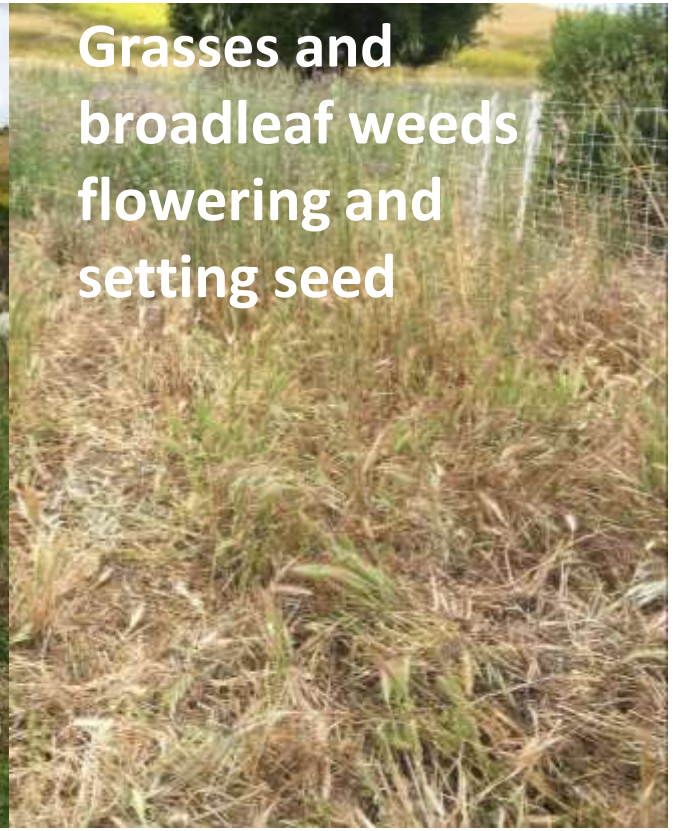
- Mow + rake: immediate reduction in thatch in 2018
- Grazing: more delayed reduction in thatch, similar to mow + rake by 2019
- Thatch reduction still evident 14 months later in both treatments

Bee Flat Grassland: Post-grazing and De-thatching

- Thatch disruption can release aggressive forbs
- Disturbed areas dominated by tarweed in summer 2019
- Areas with good needlegrass cover resisted forb invasion
- Continued monitoring planned

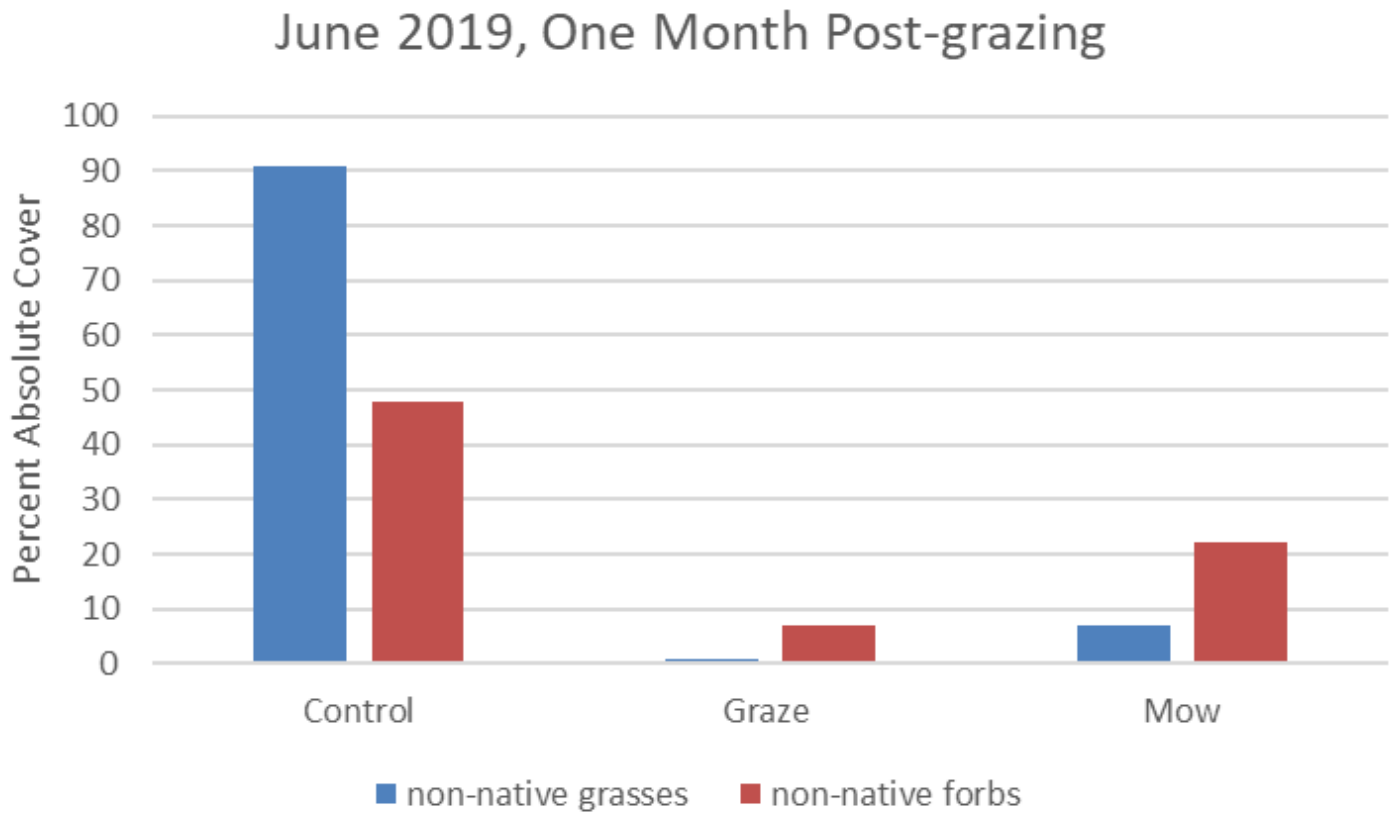
Case Study #1 Conclusions

- Both grazing and mow + raking reduce thatch thickness. Reduction may persist longer than one year.
- Goats de-thatch by trampling, not by consuming thatch.
- Carefully timed grazing in mid-spring may impact non-native grasses with little harm to needlegrass. However, impacts can occur near staging areas or if over-grazed.
- Thatch disruption may increase forb cover, particularly in over-grazed or disturbed areas.
- Raking (without mowing) may benefit needlegrass while decreasing non-native grass cover.
- Further study needed: mowing vs. raking, season of de-thatching.



Case Study #2: City of Irvine Bommer Site Preparation

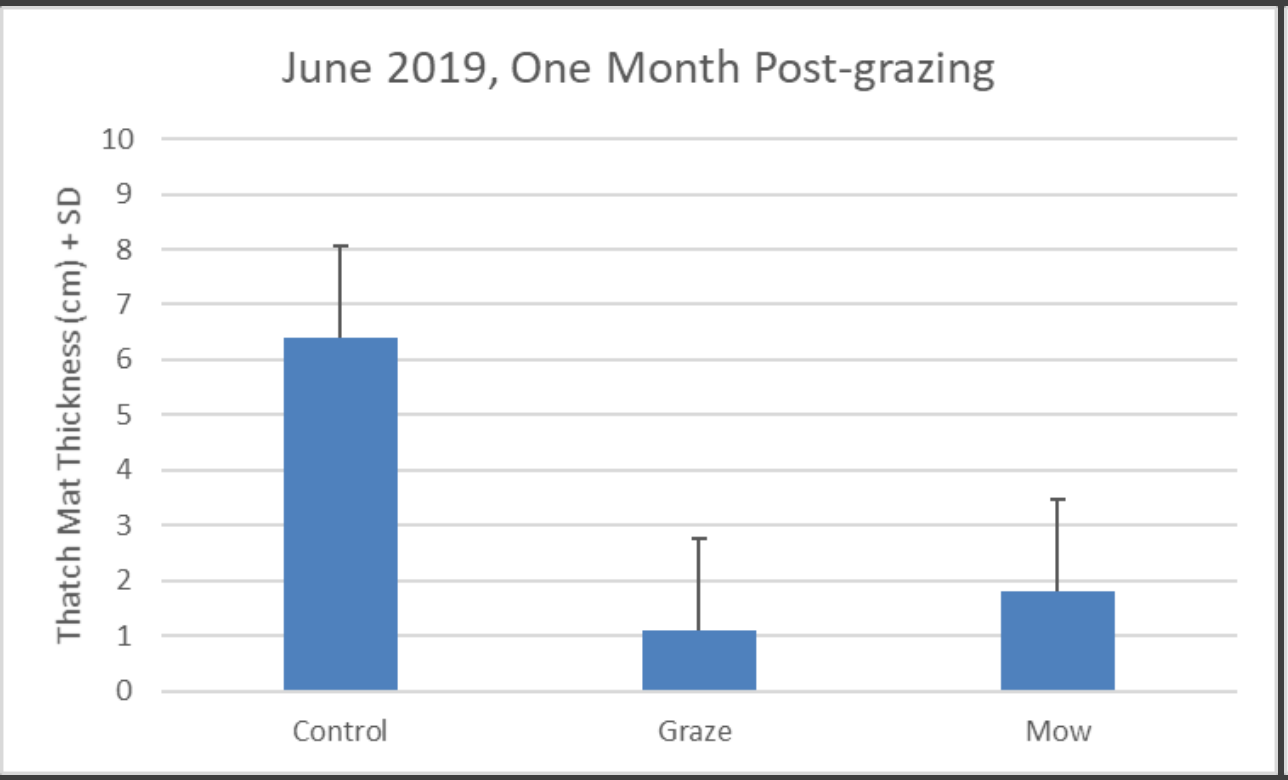
- Pilot project in grazing-based site preparation
- Can medium-duration grazing prevent weeds from setting seed?
- 65 goats introduced to 4-acre site from April 25 – May 24
- Two grazing cycles
- Mowing conducted twice in adjacent areas
- Cover, canopy height, and thatch thickness data collected June 2019 (1-month post-grazing)

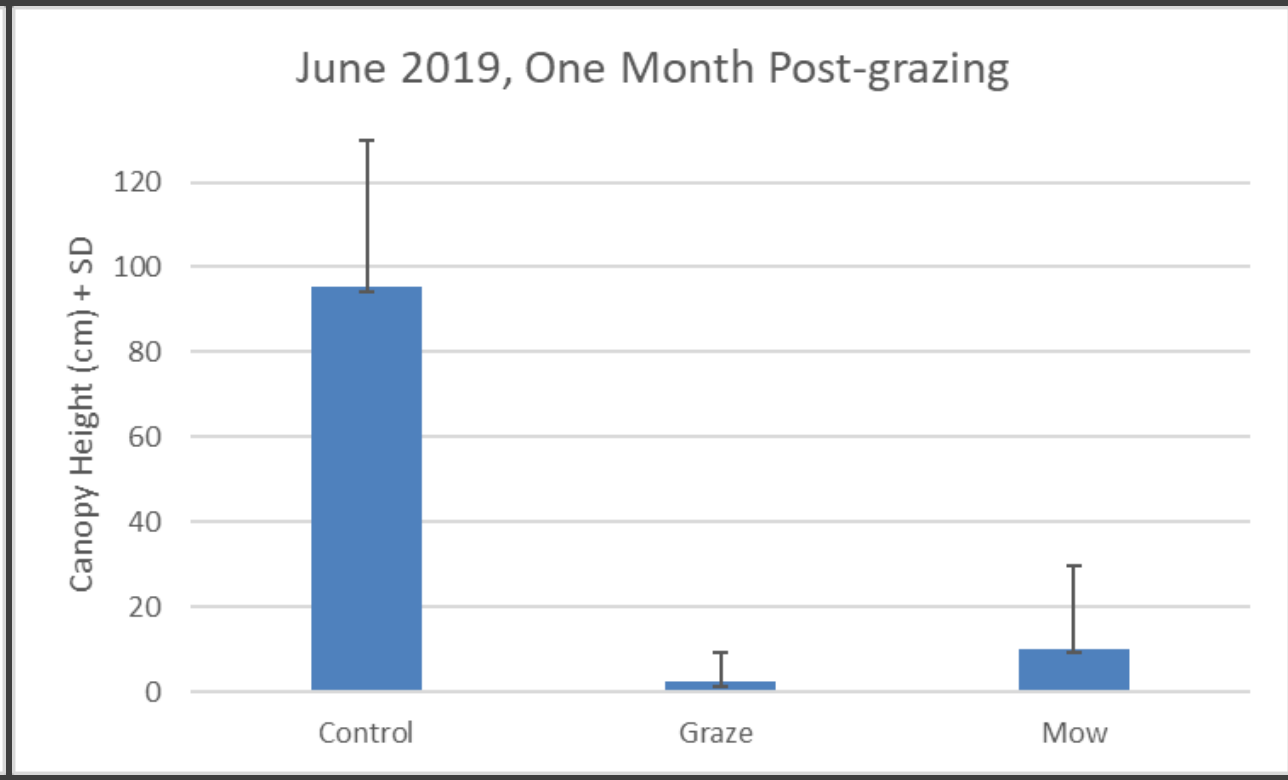


- Grazed areas had little re-sprouting of annual grasses but some re-sprouting of broadleaf weeds

Vegetation Cover

Thatch Thickness and Canopy Height





Grazing reduced average thatch thickness from 6.5 to 1 cm

Grazing reduced average canopy height from 95 to 2.3 cm

Seed Viability in Goat Droppings?

Test #	1 Soil + Seed	2 Soil + Seed + Goat Droppings	3 Soil + Goat Droppings (no seeds)
Sample	***Elymus triticoides seeds* planted in sterile soil**	***Elymus triticoides* seeds planted in sterile soil with goat droppings**	**Sterile soil, no seeds planted, goat droppings only**
Result	***Elymus triticoides* sprouted**	***Elymus triticoides* sprouted; No weeds sprouted**	**Nothing spouted**
Photo			

- **Question**: What is the viability of seeds that have passed through a goat's digestive system?
- **Approach**: Conducted germination test using new sterile soil, new native grass seed, and goat droppings
- **Method**: Distributed these materials into three flats and watered them weekly
- **Conclusion**: Nothing sprouted from goat droppings

Case Study #2 Conclusions

- Grazing for one-month eliminated weed canopy and reduced thatch layer
- Only minor re-sprouting of annual grasses (<1 percent cover)
- Broadleaf weeds re-sprouted post-grazing and required additional control measures
- No indication of viable seed in goat droppings
- Preliminary data suggest medium-duration grazing may be effective site preparation tool
- Two mowing events insufficient to provide adequate control of annual grass and broadleaf weeds.

Comparative Costs and Considerations

	Tractor Mow + Rake	Weed Whip + Rake	Grazing
Preferred Site	Level sites with good access	Better for rocky, steep sites or restricted access	Feasible at all sites
Mobilization Costs	Minor (equipment transport, maintenance)	Minor (equipment transport, maintenance)	Significant (fencing, staging area set-up and tear down) $1500 flat fee
Per Acre Costs	$180/ acre	$1000 – 1400/ acre	$750-1500/ acre (costs increase for multiple events)
Speed	Fast	Slow (0.5 acre/day), 3- to 5-person crew	Slow (0.5 acre/ day), 100 animal herd
Site Size	Small to large	Very small to medium (< 10 acres)	Medium to very large (>10 acres)

GRAZING	MOWING
+ Consumption of seed heads means reduced likelihood of weeds re-sprouting	- Repeated mowing necessary due to re-sprouting
+ Consumption of biomass	- Thatch disposal may be necessary
+ Improved nutrient recycling via droppings and thatch decomposition	
+ Public relations benefits	- Viewed as nuisance by public

Conclusions: Grazing vs. Mowing

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Questions & Answers

Bee Flat

Bommer Canyon

Bommer Canyon

Bommer Canyon

Operations

Guard Dogs

Guard Dogs

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