



MIDPENINSULA REGIONAL OPEN SPACE DISTRICT





Results and Conclusions of Science Advisory Panel Research on Grazing Topics

November 4, 2020



Fog at Toto Ranch
Photo credit: Sophie Christel



Tonight's goals

1. Receive a presentation of SFEI's findings on the Board's selected grazing topics
1. Answer questions from the Board regarding the state of the science, and the conclusions drawn in SFEI's report



Item Agenda

- Introduction and Context
 - Science Advisory Panel purpose/process refresher
 - Overview of District's Conservation Grazing Program
- SAP Presentation
- Next Steps
- Q&A with SAP, Midpen subject matter experts, and technical advisory committee



Purpose of Science Advisory Panel (SAP)

- To “Enhance the scientific validity of ecosystem management decisions and serve as an important resource to inform regional management topics” (R-19-32)
 - Objectively review and interpret the best available science
 - Communicate findings to staff, Board and public
 - Provide scientific basis to guide open space management decisions



SAP Timeline





Grazing Topic

Approved by full Board in Jan 2020 following review by PNR

- What is the net climate impact of cattle grazing (e.g., potential increase in soil carbon minus cattle methane emissions)? What are the District's options, such as grazing regimes or dietary additives, to reduce emissions from cattle grazing?
- What are the current scientific results on the effectiveness of managing grasslands and reducing fire risk with cattle grazing?
- How does cattle grazing as a land management strategy compare to alternatives in achieving District goals including climate protection and what are the trade-offs?



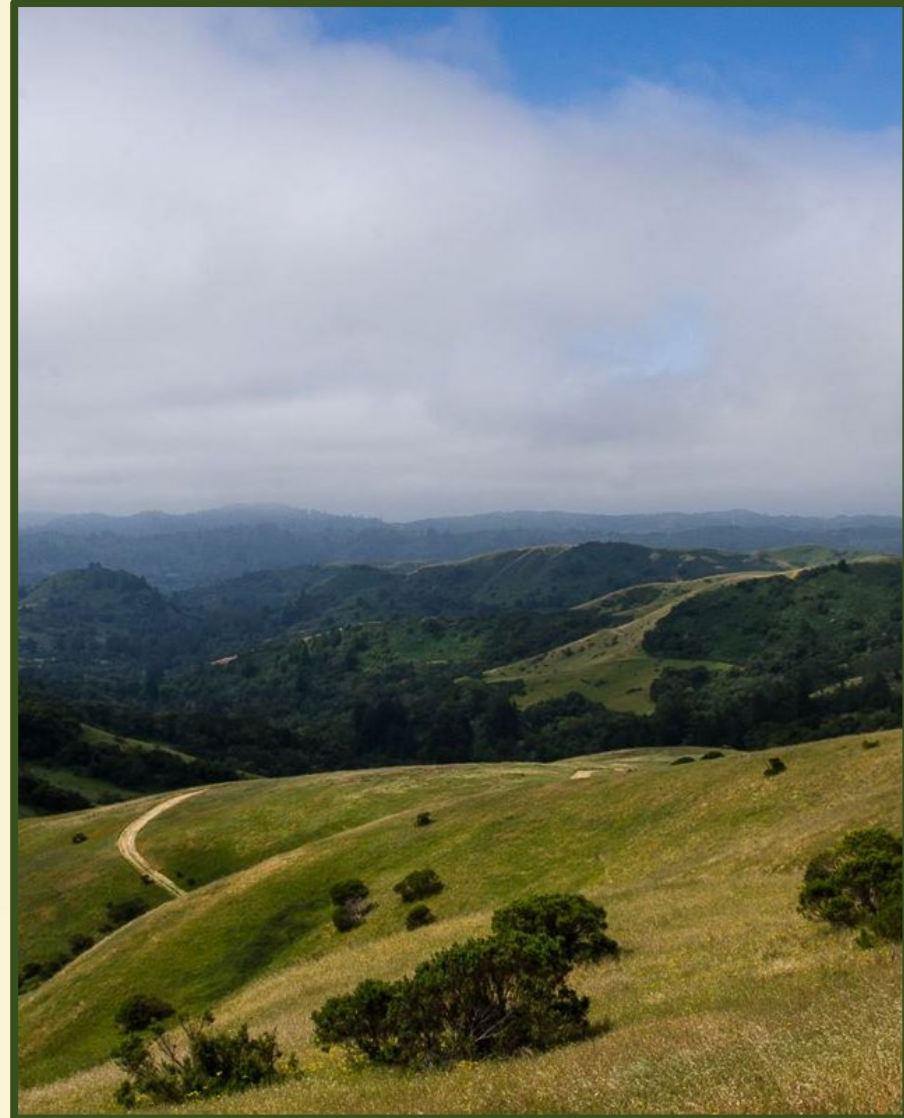
Background: Conservation Grazing Program





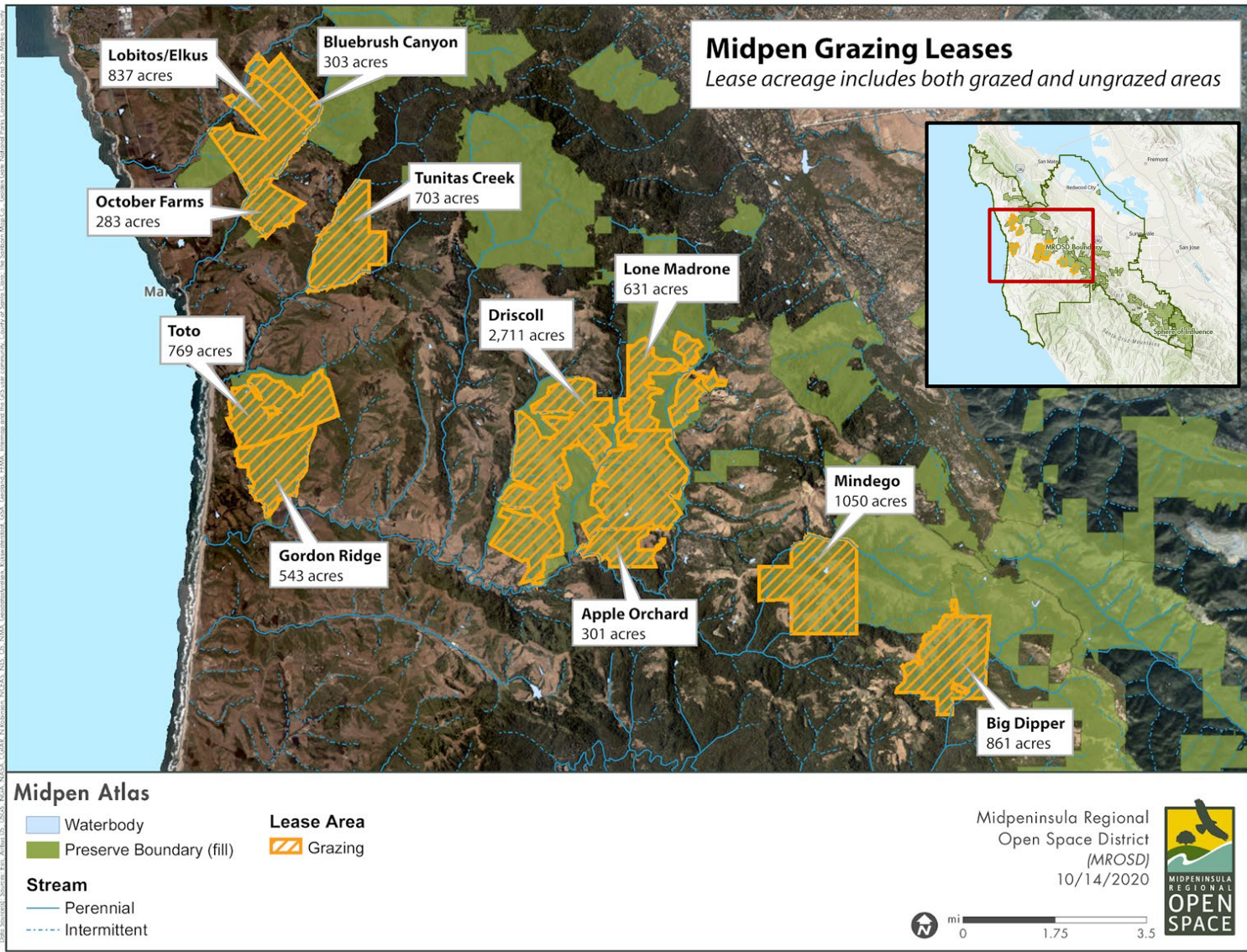
Conservation Grazing Program

- ~9,000 acres leased to conservation grazing ranchers
- 7 ranchers
- 11 properties
- 5 preserves
- Leases range from ~280 to ~2,700 acres
- Stocking capacity per grazing area ~20 to ~193 head
- ~550-600 conservation grazing cattle in total





Background: Conservation Grazing Program





Coastal Service Plan/Coastal Mission

- High development pressure on San Mateo Coast in 1990s
- Locals wanted open space and agricultural heritage protected
 - Agriculture is important to local economy, history
- Midpen developed Coastal Service Plan and Coastal Mission
 - Multi-year process with substantial public input led to Coastal Mission additions
 - **“preserve rural character [and] encourage viable agricultural use of land resources”**
 - >11,000 acres protected since the Coastal Annexation in 2004



Midpen's Resource Management Policies

Resource Management Mission Statement

- The District will protect and restore the diversity and integrity of its resources and ecological processes for their value to the environment and to people, and will provide for the use of the preserves consistent with resource protection.

Specific policies include

- Wildlife
- Vegetation
- Water
- Grazing Management
-and more



Grazing Management Policy Goals

- Manage District land utilizing livestock grazing that is protective of natural resources and compatible with public access
- Maintain and enhance the diversity of native plant and animal communities
- Manage vegetation fuel for fire protection
- Help sustain the local agricultural economy
- Preserve and foster appreciation for the region's rural agricultural heritage



Results and Conclusions of Science Advisory Panel Research on Grazing Topics

November 4, 2020



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Science Advisory Panel: Effects of Cattle Grazing on Midpen Management Goals

November 4, 2020

Prepared for Midpeninsula Regional Open Space District
by the San Francisco Estuary Institute

SFEI | AQUATIC
SCIENCE
CENTER

Background

Grassland ecosystems of California's central coast: a history of natural and imposed disturbance

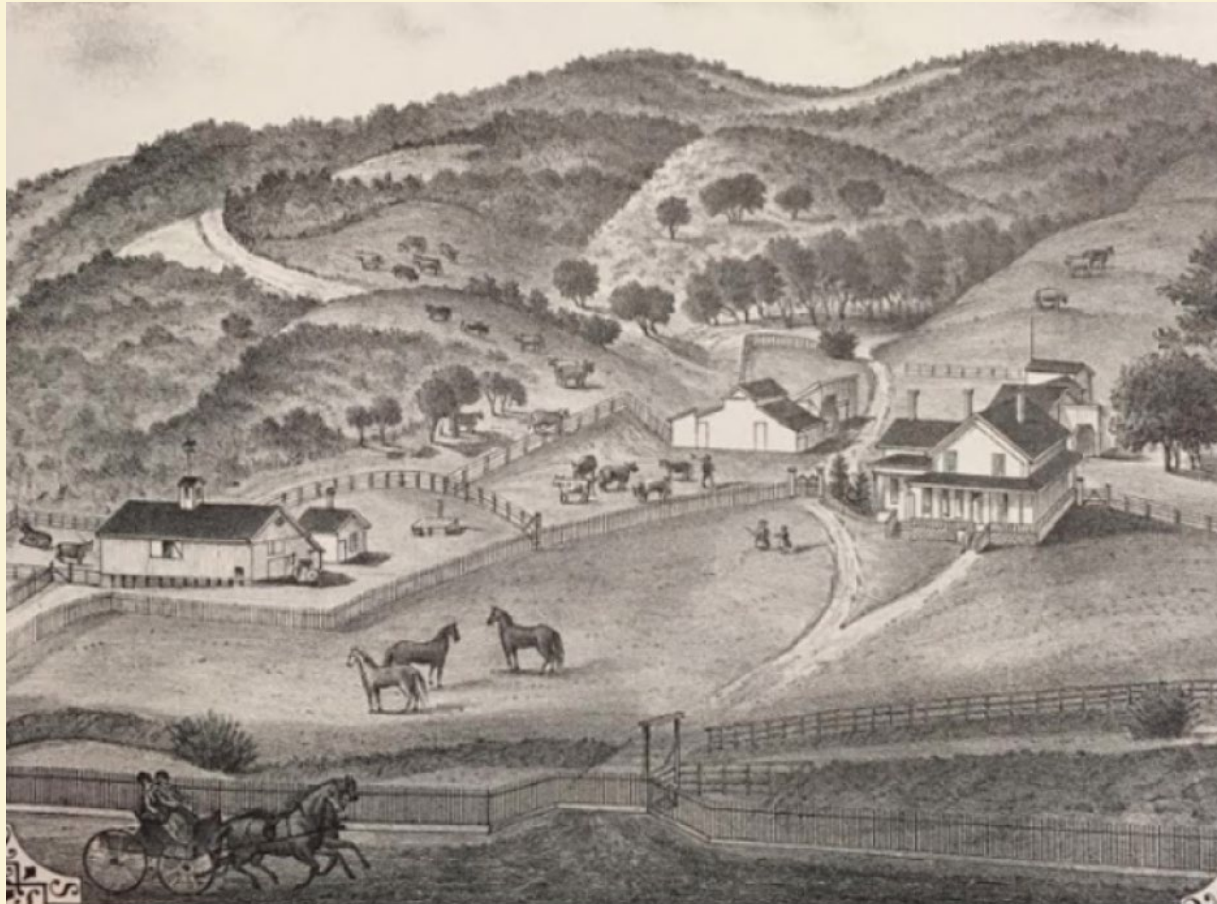


Image from Moore and DePue (1878) Illustrated History of san Mateo County

Background

California grasslands remain hotspots for biodiversity



Burrowing owl



California red-legged frog



Santa Cruz tarplant



San Francisco garter snake



Background

Biodiversity conservation in California rangelands:
conservation grazing as a management tool?



Research question

What are the effects of cattle grazing on Midpen's management goals?



Biodiversity support



Climate protection



Wildfire risk management

Alternatives to cattle grazing?



Project structure and scientific team

What are the effects of cattle grazing on Midpen's management goals, including conserving biodiversity, protecting the climate, and managing wildfire risk?

- Literature review
 - Peer-reviewed literature only
 - >125 scientific articles
 - Focus on San Mateo coast
- Synthesis workshop with Midpen staff
- Report

Project structure and scientific team

Project structure and scientific team



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Overview of findings

What are the effects of cattle grazing on Midpen's management goals?



Biodiversity support



Climate protection



Wildfire risk management





Grazing and biodiversity

Cattle grazing: an introduced disturbance that affects vegetation composition, function, and structure

- Native and non-native grassland vegetation
- Woody vegetation
- Native wildlife habitat



Grazing and biodiversity: grassland vegetation

Native grasses: varied effects of grazing on native grass diversity and abundance



Purple needlegrass (*Stipa pulchra*)



California oatgrass (*Danthonia californica*)

Grazing and biodiversity: grassland vegetation

Native forbs: some benefits of grazing,
but mixed findings among studies

- Common recommendation:
maintain a mosaic of grazed
and ungrazed sites



Example study: Hayes and Holl, 2003
Conservation Biology

- Grazing increased cover and
diversity of annual native forbs
but decreased cover of perennial
native forbs



Grazing and biodiversity: grassland vegetation

Non-native forbs: effects and opportunities

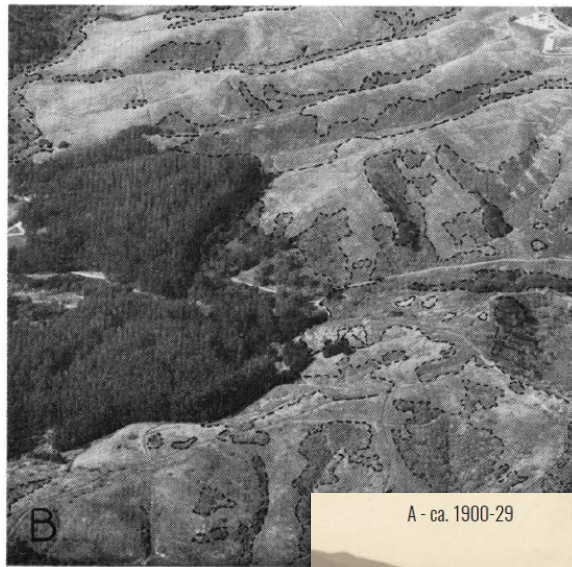
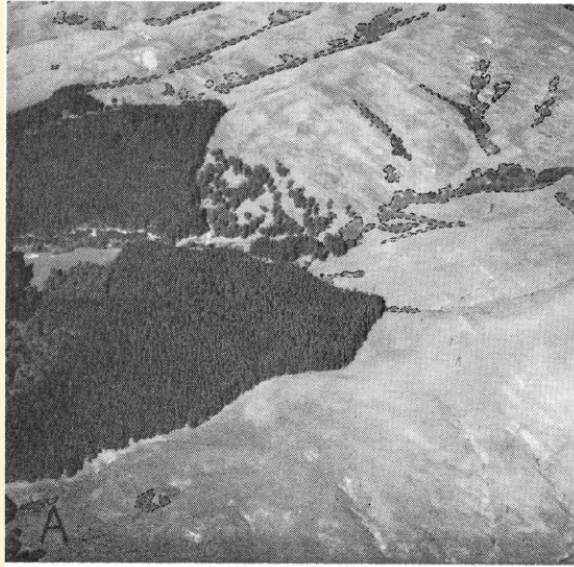
- Grazing can benefit non-native forbs
- But grazing can be tailored for invasive species control



Yellow starthistle in ungrazed paddock (left side)

Image from Thomsen et al., 1993. *California Agriculture*

Grazing and biodiversity: woody vegetation



Shrub expansion in the East Bay hills
McBride and Heady, 1968. *J. of Range Management*

Shrub encroachment in coastal California grasslands: cattle exclusion and fire suppression

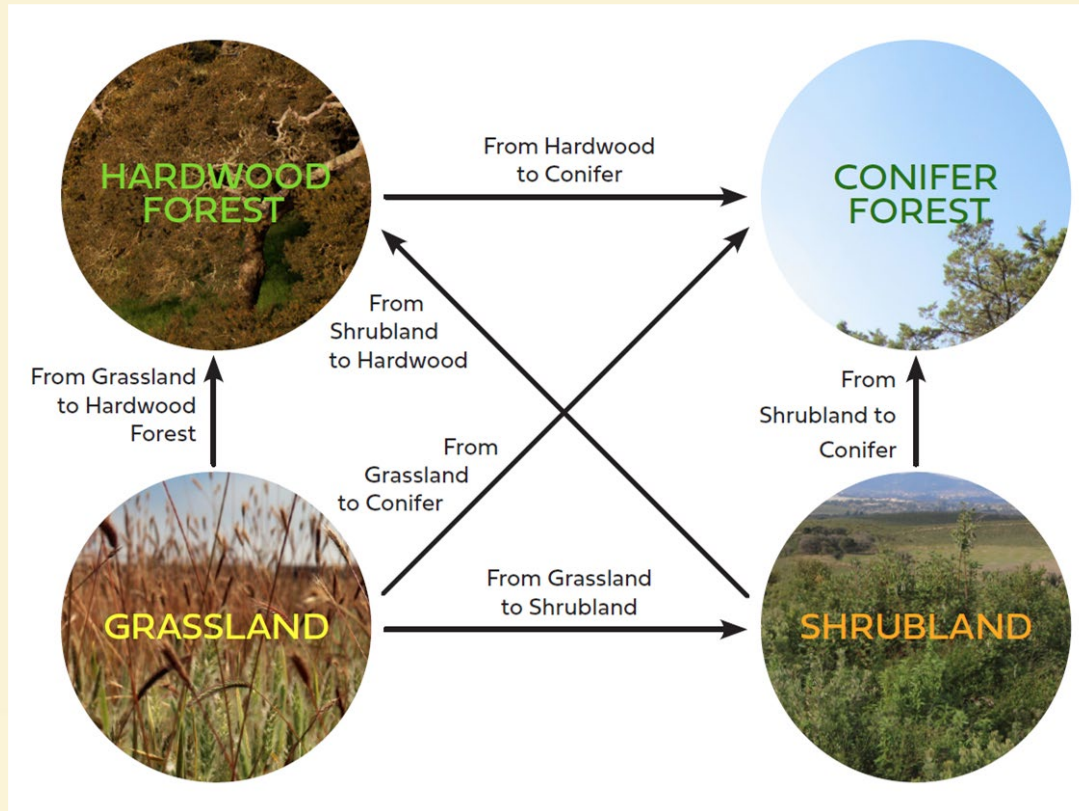
→ Influences fire hazard and herbaceous plant diversity



Woody encroachment around the lower Crystal Springs reservoir

Grazing and biodiversity: woody vegetation

Shrub encroachment in coastal California grasslands: succession and vegetation change



Grazing and biodiversity: native wildlife habitat

Native wildlife: habitat benefits of grazed grassland



Western meadowlark



Burrowing owl



Grasshopper sparrow



California red-legged frog



Grazing and biodiversity: conclusions

Herbaceous vegetation composition and structure

- +/- Native grasses
- +/- Native forbs
- + Non-native forbs
- Invasive species of concern

Woody vegetation

- Coyote brush
- + Open grassland
- + Herbaceous plant diversity and abundance

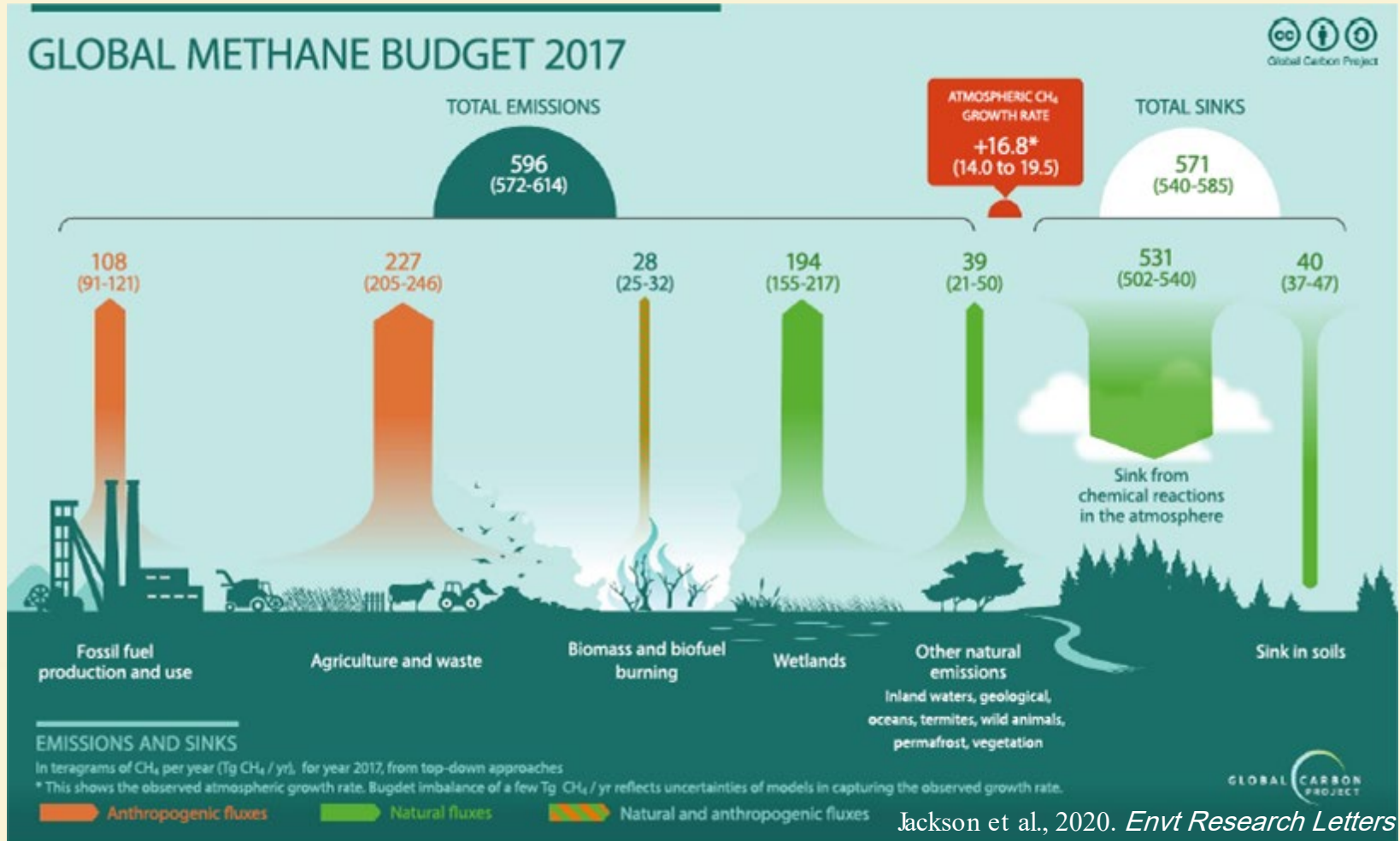
Wildlife habitat

- + Short-statured vegetation (benefits native songbirds)
- + Heterogeneous vegetation (benefits native songbirds)
- + Bare ground (benefits native songbirds)
- + Stock ponds (benefits CA red-legged frog and other wildlife)

Maintaining a mosaic across the landscapes of grazed sites, ungrazed sites, and different grazing regimes can benefit the various plant and wildlife species present on Midpen lands

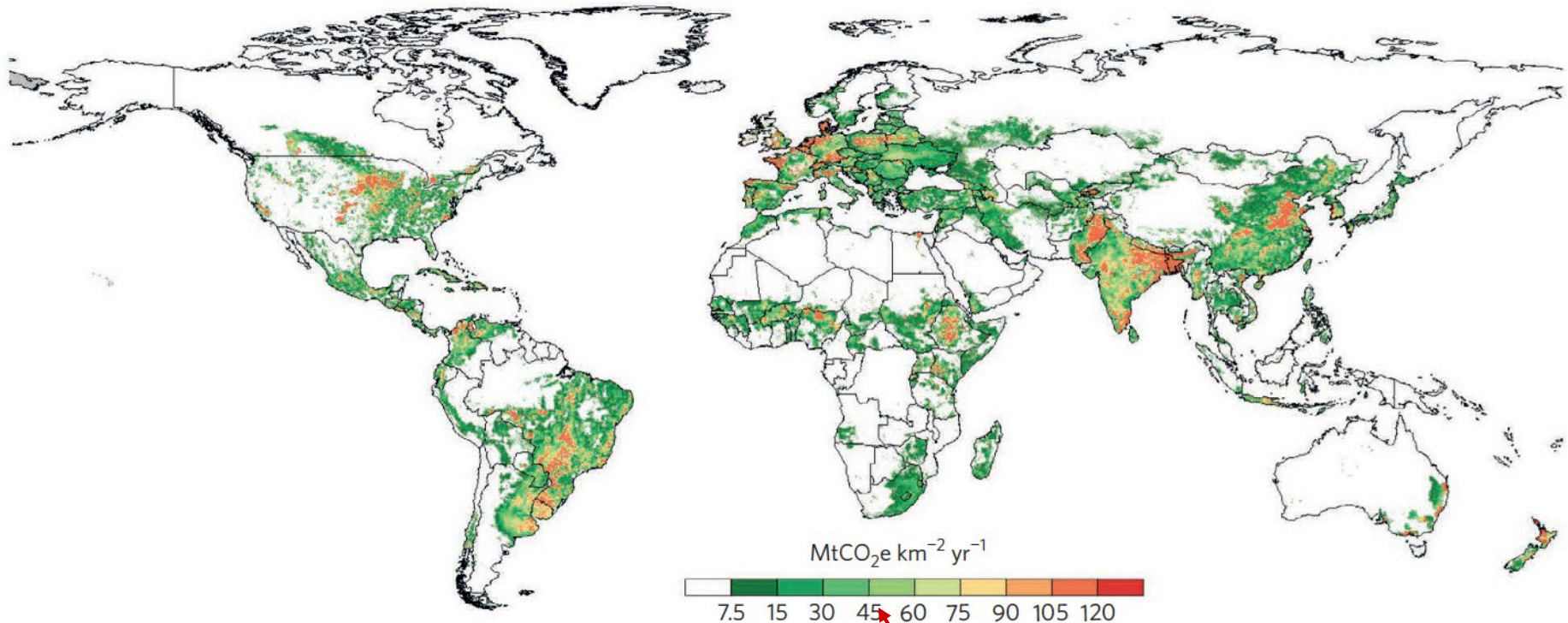
Grazing and climate protection

Cattle, methane, and the climate



Grazing and climate protection

Midpen grazing greenhouse gas emissions in perspective



Herrero et al., 2016 *Nature Climate Change*

Midpen grazing greenhouse gas emissions



Grazing and climate protection

Opportunities to reduce or offset livestock greenhouse gas emissions

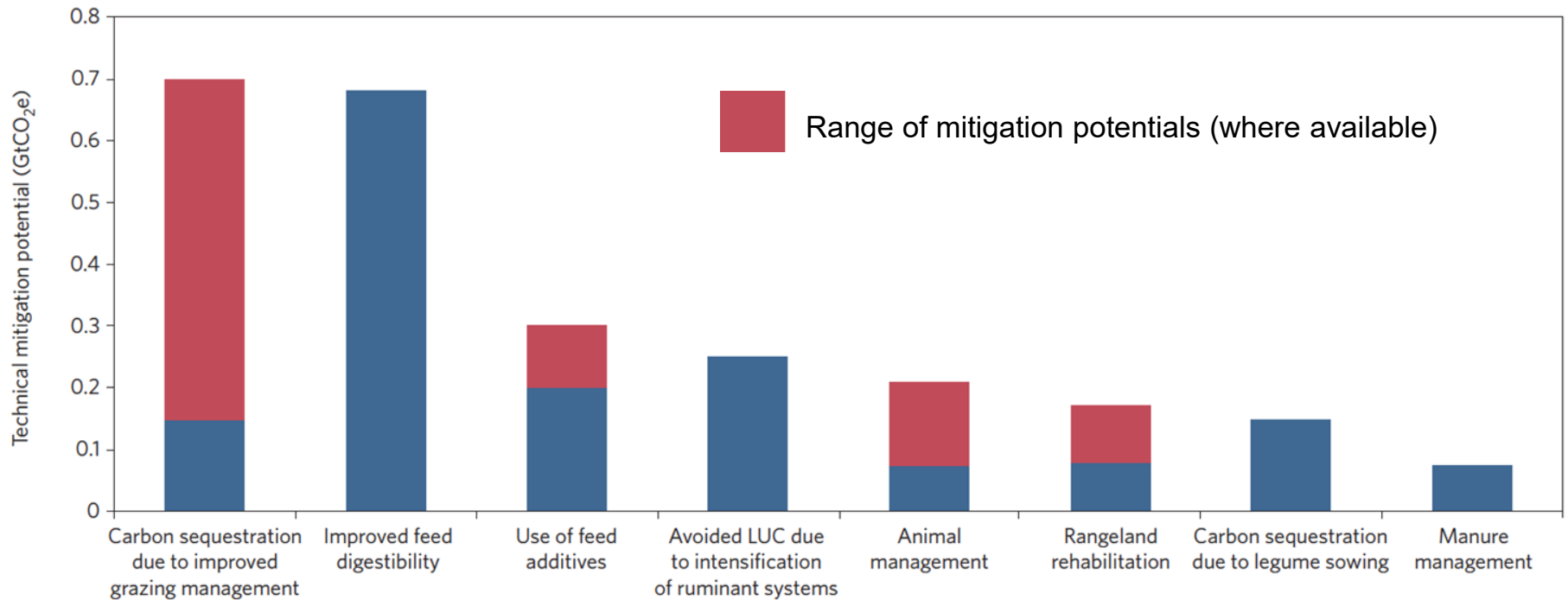
- Broad picture: carbon management in agricultural systems
- Managing livestock for soil carbon sequestration
- Other approaches for rangeland carbon management





Grazing and climate protection: reducing livestock emissions

Strategies to reduce or offset livestock greenhouse gas emissions



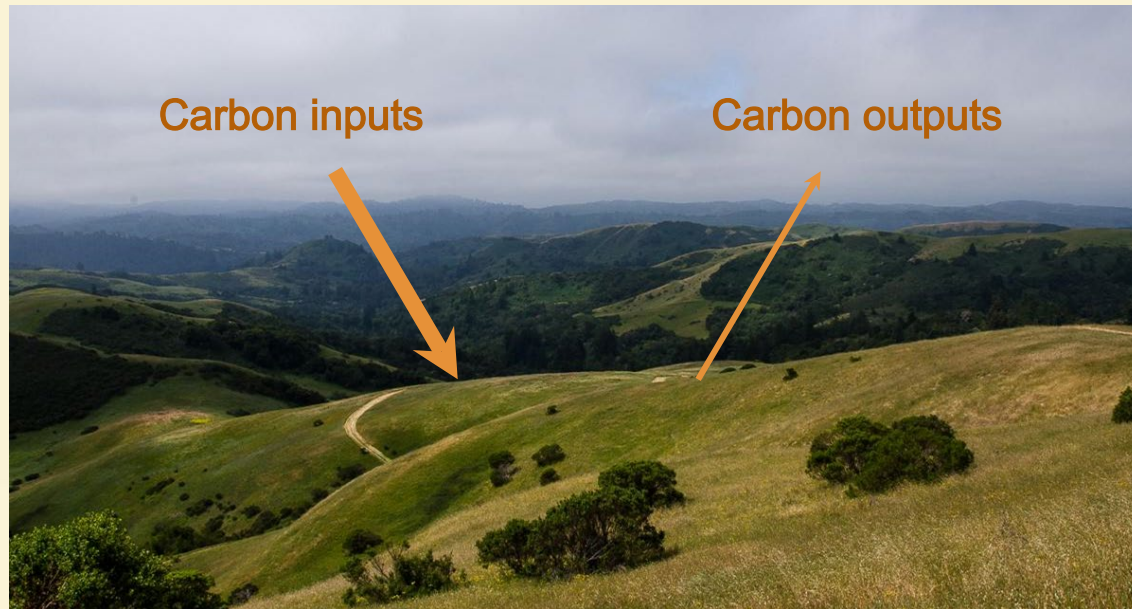
Herrero et al., 2016. *Nature Climate Change*

Greatest promise in degraded lands and sites with less-developed economies

Midpen lands and livestock are already well managed

Managing rangelands to sequester soil carbon - carbon farming

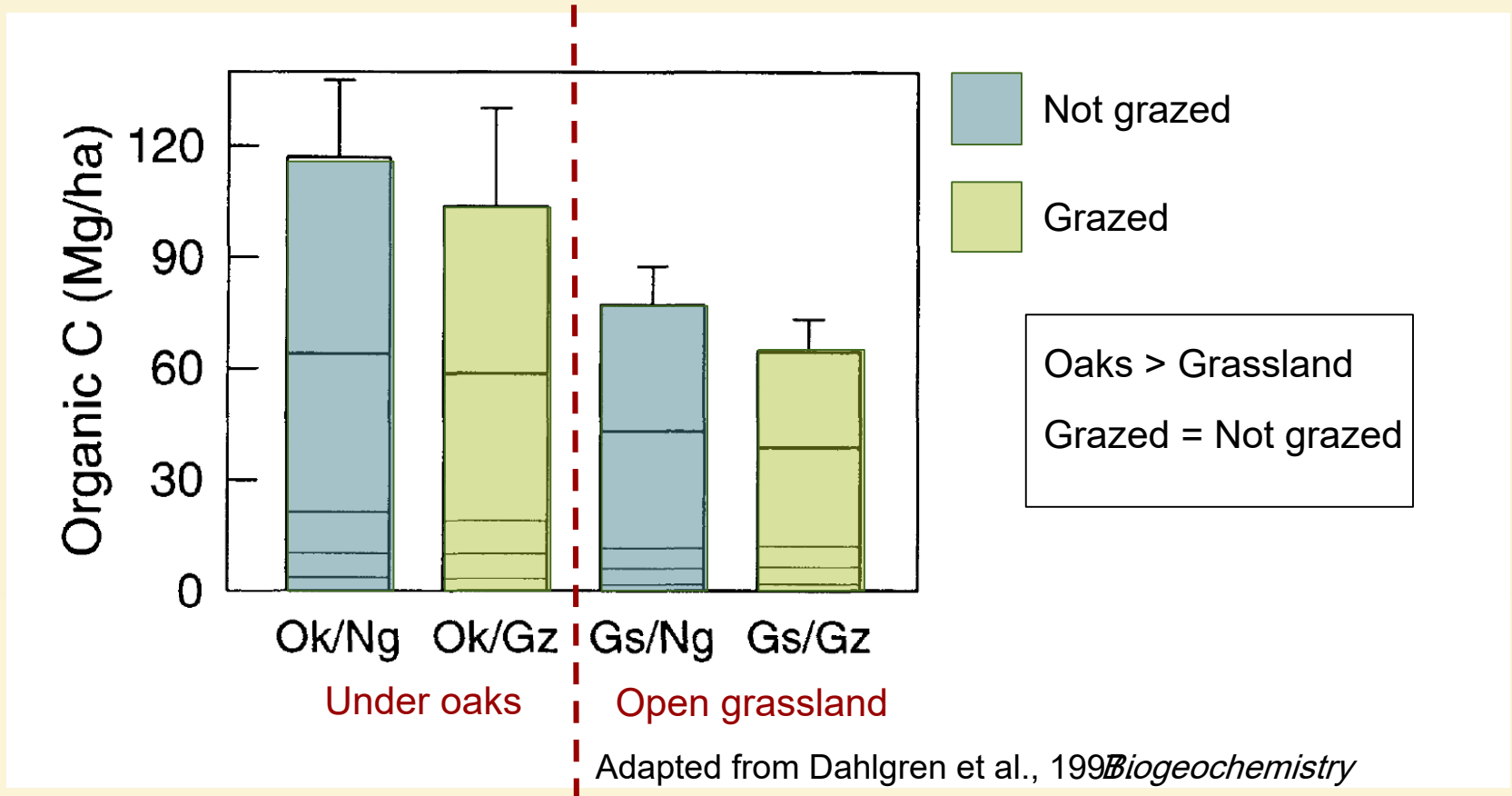
- Improved grazing management
- Compost applications
- Silvopasture and riparian regeneration



Grazing and climate protection: California rangeland soil

Grazing management for soil carbon sequestration

Studies from California suggest that grazing management is not a promising strategy to increase soil carbon storage



Other carbon management strategies for California rangelands

Compost applications

Sequestration potential: ~160 kg per acre per year



Riparian restoration

Sequestration potential: ~1600 kg per acre per year



Image from Carey et al., 2020. *California Agriculture*



Grazing and climate protection: conclusions

Cattle grazing is a source of greenhouse gases to the atmosphere. Unless these greenhouse gas emissions are offset through carbon sequestration or other emissions reductions, this presents a tradeoff with Midpen's other land stewardship goals.

Land-based carbon management opportunities

Improved grazing management ← **Low potential**

Compost applications ← **Uncertain benefits and tradeoffs**

Silvopasture and riparian regeneration ← **Limited potential**

Cattle grazing and wildfire risk management

Livestock grazing for wildfire risk management



Shrub expansion in the East Bay hills
McBride and Heady, 1968. *J. of Range Management*

Management alternatives to cattle grazing

Alternatives to cattle grazing to manage fire risk and support native grassland biodiversity

Management portfolio



Cattle grazing



Mechanical approaches



Herbicide



Prescribed fire



Browsing by other species

Complements or alternatives to conservation livestock grazing.

Management alternatives to cattle grazing

Mechanical approaches

Uses

- Maintain open grassland
- Control invasive species

Challenges

- Only feasible on gentle terrain
- Large carbon footprint
- Expensive
- Effects not equivalent to cattle grazing



Management alternatives to cattle grazing

Herbicide

Uses

- Control invasive species
- At Midpen, screened for toxicity, efficacy, and environmental persistence and mobility

Challenges

- Expensive
- Spot applications, not broadcast treatments



Management alternatives to cattle grazing

Prescribed fire

Uses

- Manage fuel loads
- Control invasive species

Challenges

- Expensive
- Requires permitting
- Effects depend on site characteristics, burn frequency, and burn timing



Management alternatives to cattle grazing

**Alternative herbivore species:
sheep, goats, tule elk**

Uses

- Combat shrub encroachment
- Manage fire risk
- Manage vegetation species
- Particularly useful on steep terrain

Challenges

- Sheep/goats: risk of livestock-predator conflict
- Elk: difficult to manage (fencing and population control)
- Ruminants: release methane



Management alternatives to cattle grazing

Each of these options may best be seen as a complement, rather than an alternative, to conservation livestock grazing.



Cattle grazing



Mechanical approaches



Herbicide



Prescribed fire



Browsing by other species



Conclusions and recommendations

There are many ways to graze. Midpen's **conservation grazing** program entails low stocking rates, residual dry matter (RDM) targets, biodiversity monitoring to support data-driven management decisions, and fencing of riparian areas.

Conservation cattle grazing can be a **beneficial management tool** to protect open grassland, increase the diversity and cover of native grassland plants, control invasive species, and provide habitat for native wildlife, including sensitive species like California red-legged frog.

Methane emissions entail a **tradeoff** between climate protection and other land stewardship goals. Land based carbon management may offset some of these methane emissions.

Limits to the science in coastal California grasslands

- Recommendation: maintain an adaptive and science-based management approach



Prepared for Midpeninsula Regional Open Space District by

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Next Steps: Management Implications

Grazing Questions Addressed by Science Advisory Panel

- What is the net climate impact of cattle grazing (e.g., potential increase in soil carbon minus cattle methane emissions)? What are the District's options, such as grazing regimes or dietary additives, to reduce emissions from cattle grazing?
- What are the current scientific results on the effectiveness of managing grasslands and reducing fire risk with cattle grazing?
- How does cattle grazing as a land management strategy compare to alternatives in achieving District goals including climate protection and what are the trade-offs?



Next Steps: Conservation Grazing Program

- Conservation Grazing

- + Biodiversity

- + Fire fuels management

- Climate change

- ~~+ ■~~ Other Management Methods

- Other considerations

- + Coastal Mission (preserve rural character, encourage viable agricultural use of land resources)

- Staff time

- Cost

- Permitting, biomonitors

- Terrain limitations



MIDPENINSULA REGIONAL OPEN SPACE DISTRICT

Questions

