Ecosystem Service on Rangelands

*"The Benefits **People** Obtain from Ecosystems to **Maintain** **Life** on Earth"*

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Supporting

Supporting: the natural processes that maintain (support) the other ecosystems such as nutrient cycles, pollination, and habitat for wildlife.

Managed rangelands can support greater plant diversity which supports better drought tolerance, greater resistance to plant pests and invasive species, and increased biodiversity.

Provisioning

Provisioning: the goods or products obtained (provided) from ecosystems such as the production of food and water;

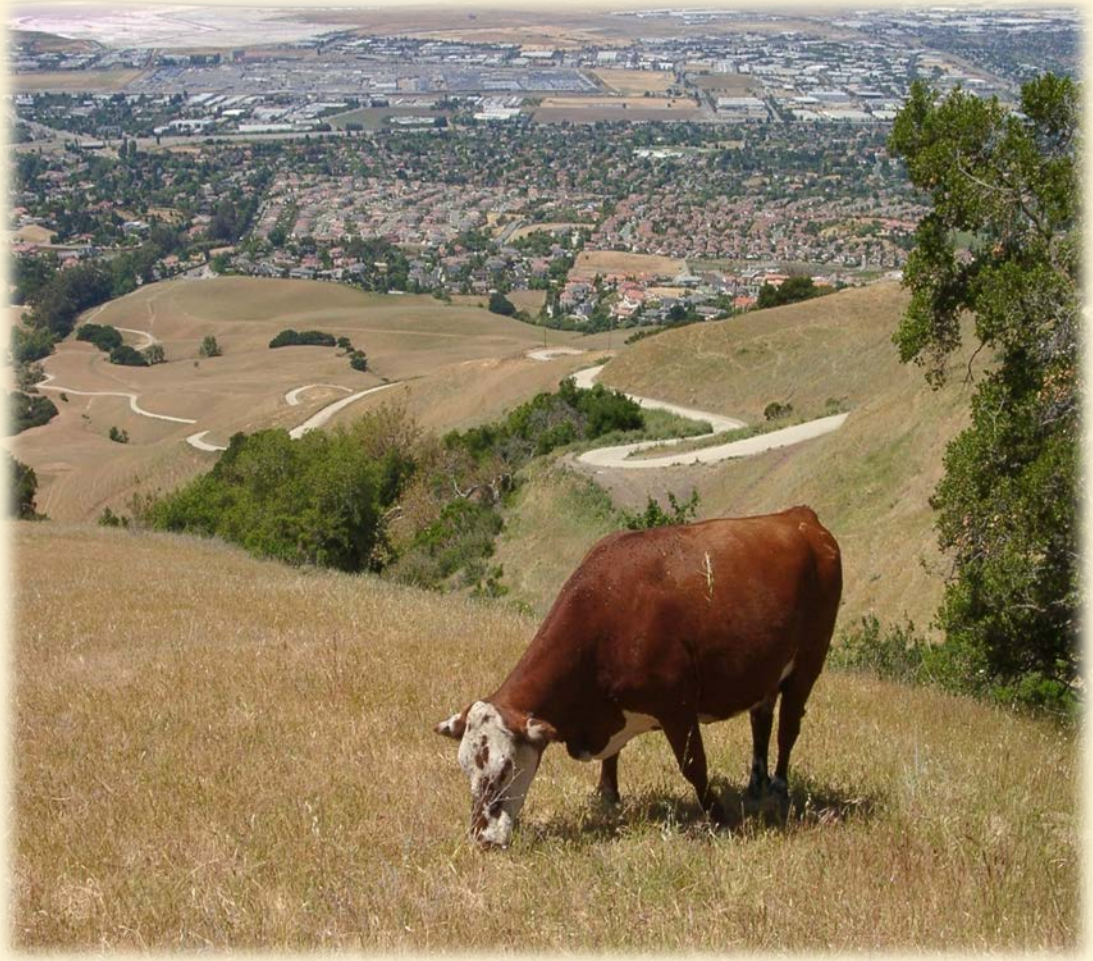
- Forage production which allows for the raising of livestock. Managed properly, the grasses grown on rangelands can provide quality feed for livestock thereby reducing the cost to raise livestock and produce food for consumers.
- Water quality and quantity, water retention and aquifer recharge. Most of California's vital water resources including water for drinking and irrigation originate on, flow through, or are stored on rangelands.

Regulating

Regulating: the benefits obtained from an ecosystem's control (regulation) of natural processes such as the control of climate, filtration of water; and growth and removal of vegetation.

- Carbon sequestration which filters carbon dioxide and other pollutants out of the air, thus increasing the carbon stored in the soil profile.
- Fire fuel reduction when lands are properly grazed, reducing fire fuel ladders by vegetation removal.

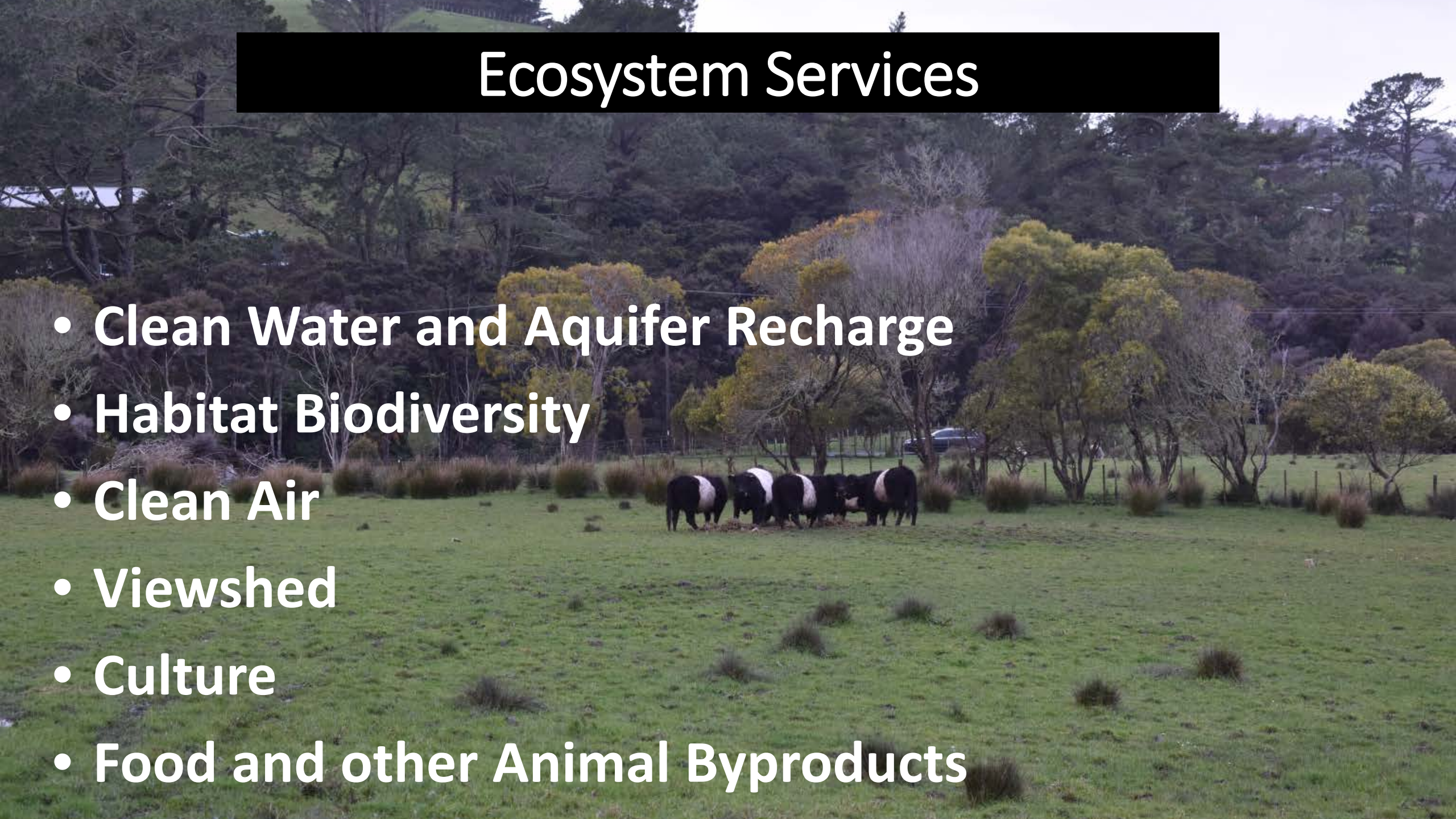
Cultural



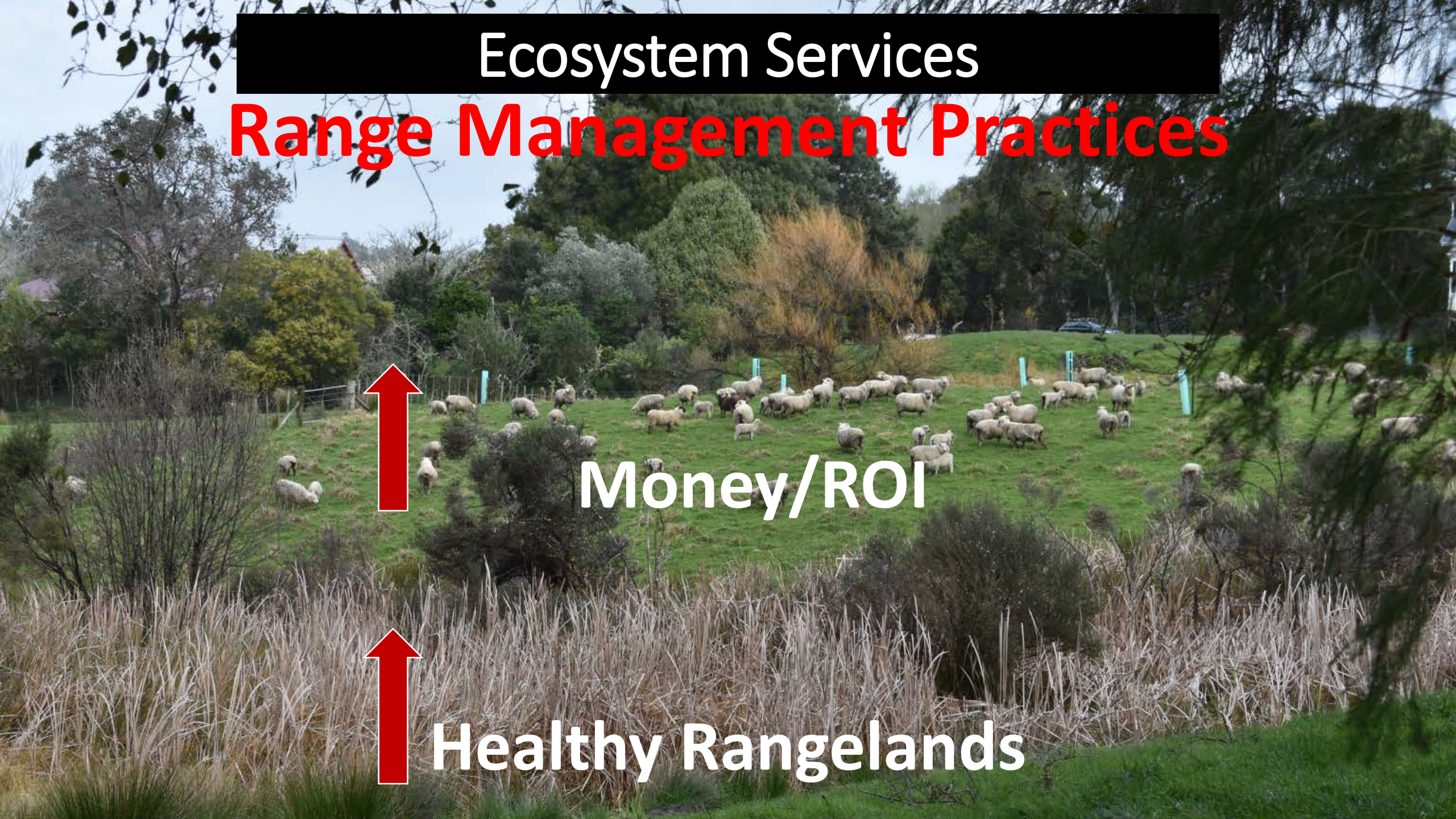
Cultural: the nonmaterial benefits obtained from ecosystems such as spiritual and recreational benefits;

- Open space and view sheds are areas of land, water, or other natural environmental elements, visible to the human eye from a fixed vantage point.
- Recreation benefits include opportunities for hiking, horseback riding, swimming, skiing, hunting and more.

Ecosystem Services



- Clean Water and Aquifer Recharge
- Habitat Biodiversity
- Clean Air
- Viewshed
- Culture
- Food and other Animal Byproducts


Ecosystem Services
Range Management Practices
Money/ROI
Healthy Rangelands

Range Management Practices

- Grazing System
- Water Sources
- Supplements
- Fencing
- Multi Species Grazing

Rangeland Example

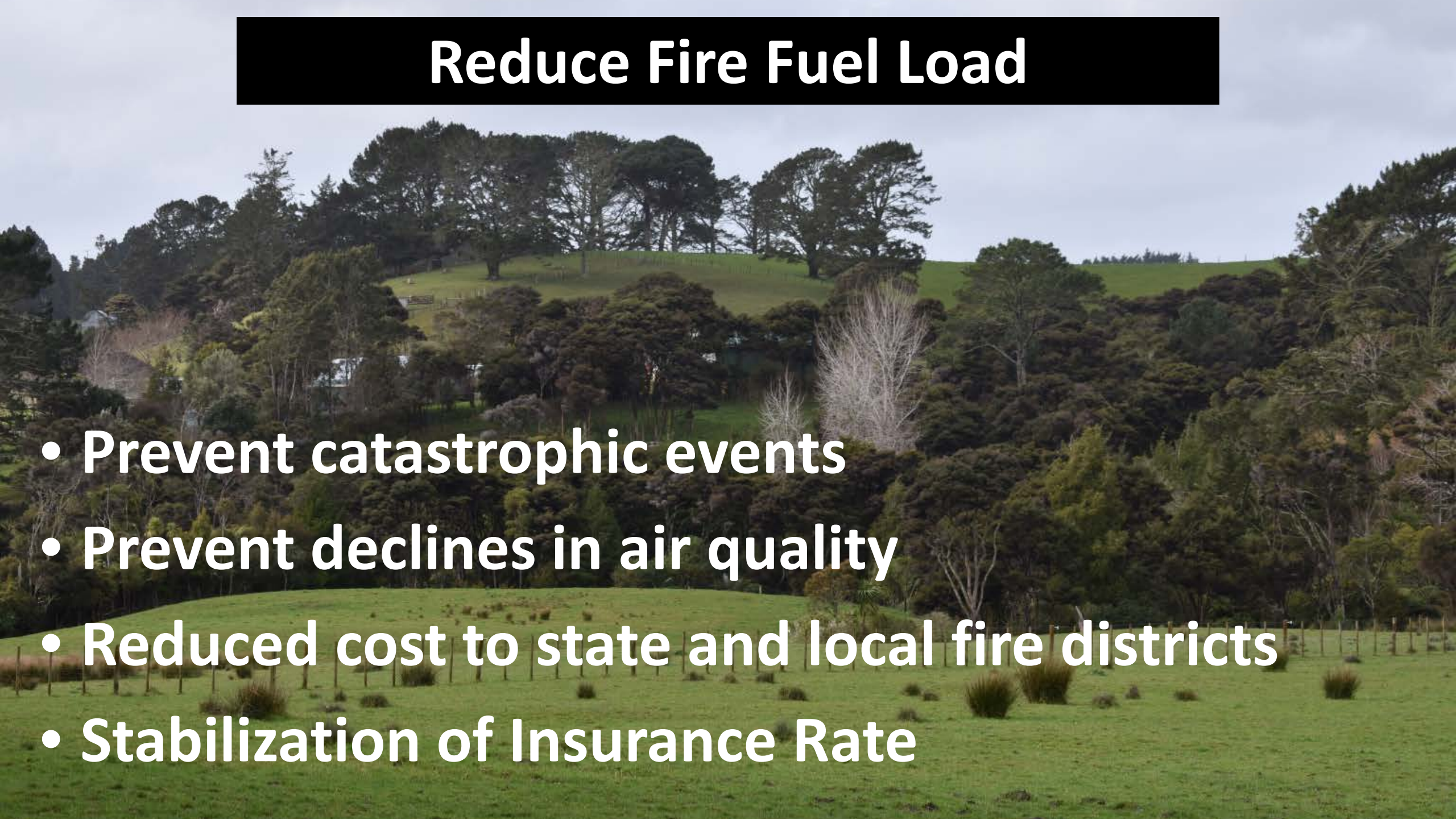
Ecosystem Service: Regulating

REDUCE THE RISK OF CATASTROPHIC WILD FIRES

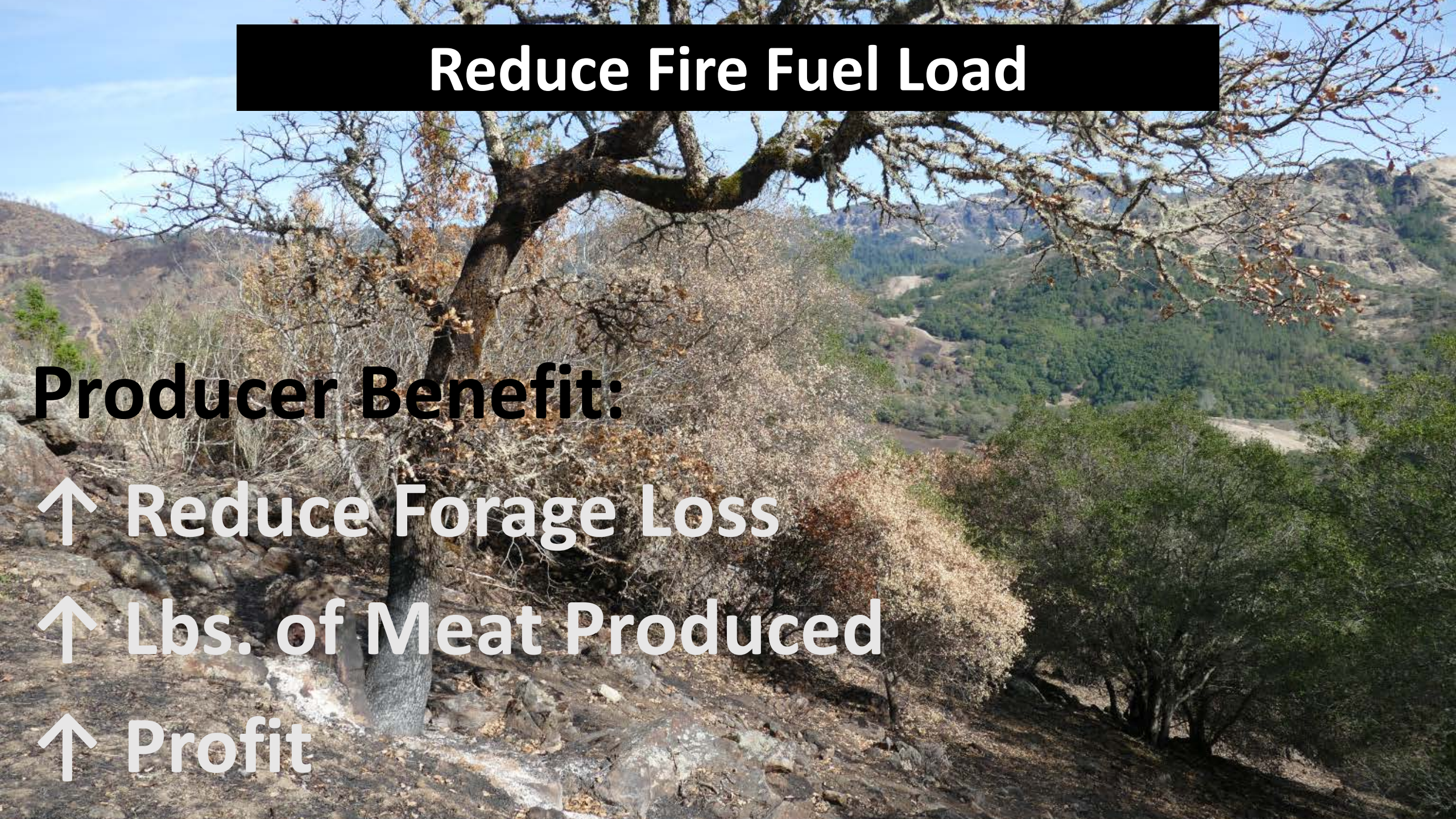
Rangeland Management Practice:

Prescribed Grazing

Reduce Fire Fuel Load



- Prevent catastrophic events
- Prevent declines in air quality
- Reduced cost to state and local fire districts
- Stabilization of Insurance Rate


Reduce Fire Fuel Load
Producer Benefit:
↑ Reduce Forage Loss
↑ Lbs. of Meat Produced
↑ Profit

Reduce Fire Fuel Load

Ecosystem Services received:

- **Maintain grasslands and associated species (Biodiversity)**
- **Reduce/Eliminate/Prevent spread of noxious weeds**
- **Meat and other animal byproducts** (Food)

Ecosystem Service Decision Support Matrix: Fire Prevention

Resource/ Inventory	Determined by ESD (Ecological Site Description) or on ground observation, or biomass/production maps, or remote sensing of http://safety.ucanr.org/Programs/Business_Travel/production. Historical use and carrying capacity.
Resource Goal	Reduce dry herbaceous layer (grass and forbs) that could fuel wildfire (green herbaceous is often not very flammable); Prevent shrub invasion into grasslands; Reduce brush
Ecosystem Service/Goal	Reduce fire fuel load and reduce the likelihood of fire.
Process	Rangeland stewardship including effective grazing management resulting in the decrease of herbaceous biomass and prevention of the accumulation of thatch and reduce or prevent the impeding of shrubs into grasslands.
Practices	Brush Management Managed Grazing Mechanical working of land Mowing Fire breaks Irrigation Planting in species that stay green through the summer (e.g. some native perennial grasses)
Outcomes	• Reduce opportunities for catastrophic wildfire and the potential loss of structures, life (human and wildlife), and forage (is habitat a better word?) • Fuel management studies have shown that spread rate and flame length are lower when dry grass fuel load is less than 800 lb/a when compared to dry grass fuel loads of 2200 lb/a (about 1 foot tall). [1] • Grazing is most effective at treating smaller diameter live fuels that can greatly impact the rate of spread of a fire along with the flame height. [2]
External Outcomes	• Prevent catastrophic events that could significantly impact water quality, increase erosion and lead to loss of structures and lives. [3] • Maintain grasslands and associated species. [3] • Maintain or increase biodiversity of species including threatened and endangered. [3] Enhances diversity of grassland species, particularly increases prevalence of forbs and legumes. • Reduced cost to state and local fire districts to fight wildland fire. • Stabilization of Insurance Rate – threat of rising rate due to risk of fire reduced. • Prevent declines in air quality – from fire that did not occur (or less smoke/fire if one does occur). • Food and fiber and other animal by-products.
Additional Information	California's rangelands are dominated by non-native annual species. These annual species thrive with and without livestock grazing and disturbance. As annuals left undisturbed they leave behind a thatch that can accumulate over time increasing fire fuel loads and/or decreasing the diversity of flora and fauna. Some of California's rangelands sites, left undisturbed are also subject to invasion by woody species. The combination of accumulated thatch and woody species accentuates the risk of catastrophic wildfire.
Reference	1. Standard fire behavior fuel models: a comprehensive set for use with Rothermel's surface fire spread model, Scott and Burgan, 2005. 2. Planned Herbivory in the Management of Wildfire Fuels, Glenn Nader, et al., October 2007. 3. Sustainable Rangelands Ecosystem Goods & Services, Breckenridge, et al., 2008.
PES Example	City of Walnut Creek paying to have goats graze an area to reduce fire load. The City is paying $5800 to have goats graze 7 acres per Contra Costa Times, 7/12/2011. Typical goat grazing fee is $700 to $1000 per acre. Incidentally, cattle previously grazed the land; the City was paid $5000 by the cattle owner. The cattle were removed from the land in 2010 "mainly due to complaints from parkland users that the cattle were unsafe and trampled the trails." The local residents petitioned the City to bring the cattle back. As of 7/12/2011 the City decided to pay to have goats graze 7 of the 178 acres.
Challenges / Opportunities	Potential tradeoffs between fuel load reduction and benefits of RDM (Residual Dry Matter) Specific timing of managed burns may Reduce/Eliminate/Prevent spread of noxious weeds such as barb goatgrass and Medusahead.

Obstacles facing landowners Payments for Ecosystem Services (PES)

Language is a jargon-rich, amalgam of scientific, financial, regulatory and conservation vernacular;

Lack of understanding of the long term economic impacts;

Lack of tools to assess ecosystem services potential;

Regulatory driven as opposed to incentive driven;

Scales public vs. private lands;

Marginal profitability most agricultural operations (working landscapes);

Integration multiple uses, multiple benefits and multiple beneficiaries

Conservation Easements

Ecosystem Service benefits not always taken into account when land use and policy decisions are made;

Challenge - to quantify biophysical and economic values of ecosystem services provided by conservation easements;

Document - ecosystem services from conservation easements and examine additional benefits received not previously documented;

Land Conversions – conversation of lands of lessor agricultural value but higher ecosystem service values.

CONSERVATION EASEMENTS

An agreement between a landowner and a conservation group that restricts development rights on a parcel of agricultural or undeveloped land in exchange for payment.

- Primary Channel for protecting private land against development
- Voluntary Agreements
- Landowner receives a one-time lump sum payment and long term tax benefits.

Conservation easements are growing in popularity: nationwide approximately 3 million acres in 2006, 8 million in 2008, 24 million in 2016.

Payments for Ecosystem Services (PES)

Study alternative payment structures for conservation easement

- In context of rancher community & identity
- Explore complementarities between conservation easements and PES schemes through the lens of identity economics (i.e. Akerlof and Kranton 2000).

Testable Hypothesis

- Landowners that strongly identify as ranchers or farmers;
- Landowners that strongly identify as members of a ranching/farming community;
- A greater preference for annual payments over lump sums, or a combination of both, than those landowners that do not.

Conservation Easement

Conservation group motivations include containing urban sprawl, preserving open space, and preserving ecosystems services such as carbon sequestration, soil health, biodiversity (Chang 2011).

Landowner motivations include preservation of rural lifestyles, intergenerational financial stability, debt repayment (Rilla and Solokow 2000).

Hedonic models based on development rights; restricts future development

Impacts on Property Taxes reduction have can occurred, but recently have seen tax increases

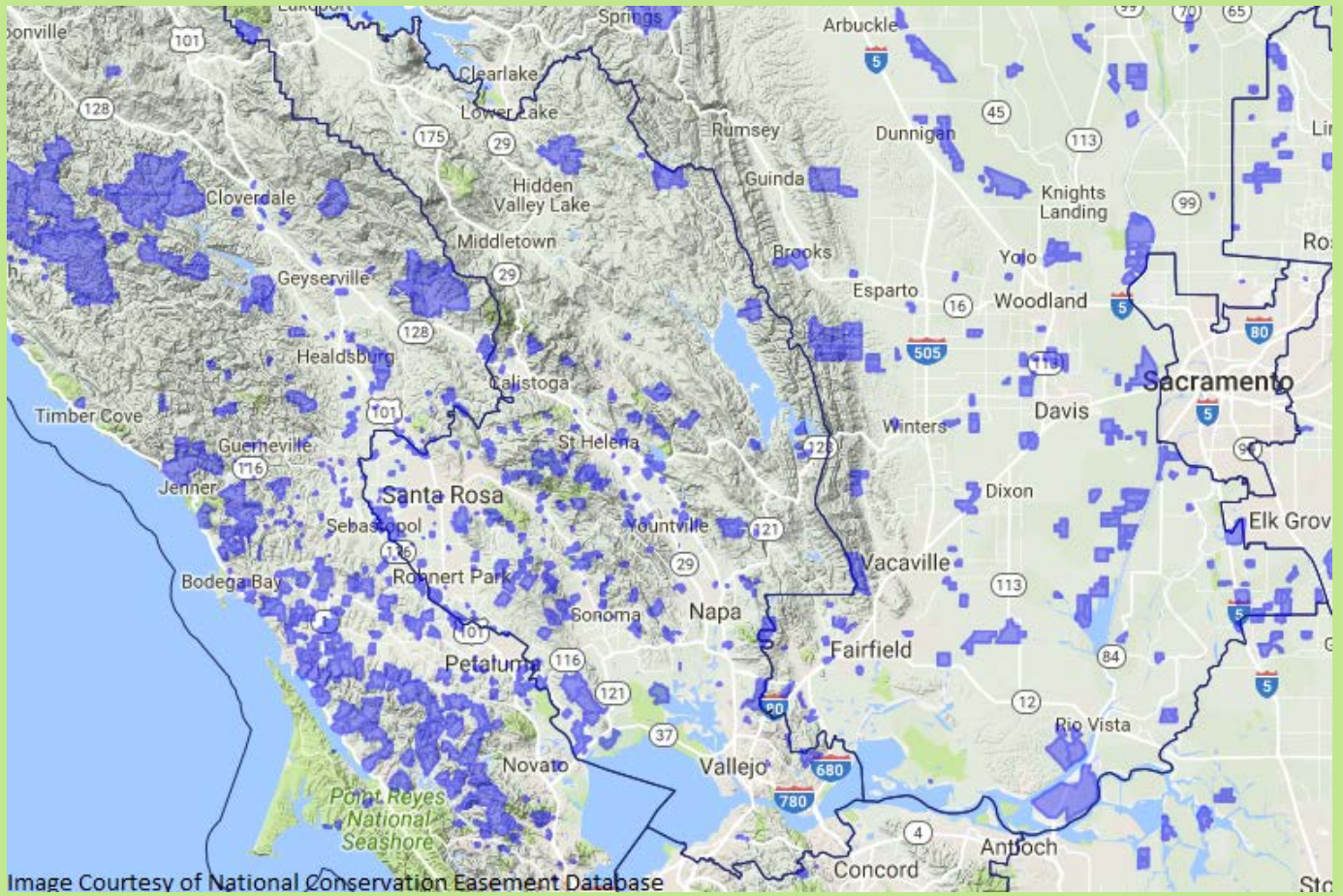
Research area

Sonoma County

Protected over 106,000 acres through easements since 1990

Marin County

Protected over 48,000 acres through easements since 1983



Land trusts include Marin Agriculture Land Trust & Sonoma County Agricultural Preservation & Open Space District

Data - Survey

Survey landowners that sold conservation easements over the past 25 years:

- Obtain conservation easements by selling their development rights;
- Purchased land that carried an easement at the time of purchase;

Also examined:

- Landowners that began process of selling an easement but did not complete the sale;
- Landowners that have never considered selling an easement.

SURVEY questions

Sample survey questions:

- What is your family's primary source of income?
- What percentage of your income comes from agricultural activities?
- What would be a fair annual PES payment for an easement on your land?
- How satisfied were you with the process?
- What would be a fair lump sum price for an easement on your land be?

Conservation Easement Payments

Managed by Land Trusts - occur on Private Lands

Based on Hedonic evaluations - development potential & loss of habitat

What if the easements were also based on Benefit-relevant indicators (BRIs) –

- Assessments made on if there is a demand for the service, how much it is used (for use values) or enjoyed/valued (for nonuse values);

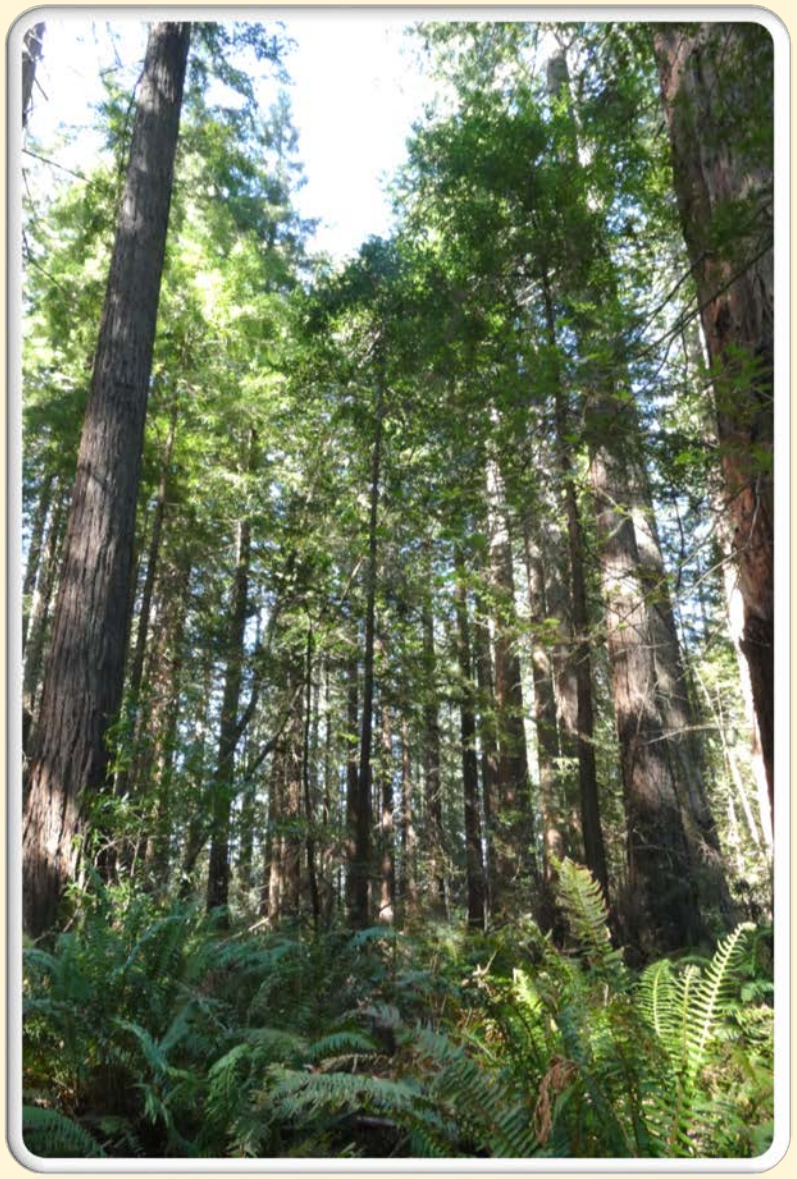
- Whether the site provides the access necessary for people to benefit from the service.

Regulating

Control of climate, filtration of water; and growth and removal of vegetation.

Benefit-relevant indicators:

- Decrease wildfires
- Qir quality
- Flood risk reduction



Cultural

Nonmaterial benefits obtained from ecosystems such as spiritual and recreational benefits;

Benefit-relevant indicators:

- Improved health
- Biodiversity
- Wildlife viewing
- Property values

Provisioning

Goods or products obtained (provided) from ecosystems such as the production of food and water;

Benefit-relevant indicators:

- Endangered species habitat
- Soil Health
- Climate change reduction

Supporting

Nutrient cycles, pollination, and habitat for wildlife.

Benefit-relevant indicators:

- Pollinators
- Increased specialty crops (diversity)
- Water Quality

Survey Results

Economic models to predict ecosystem service values;

Insight into higher relief; increase options for landowners;

Understand the importance of implicit and explicit values;

Educational opportunities to policy makers, landowners and society

Management Decisions

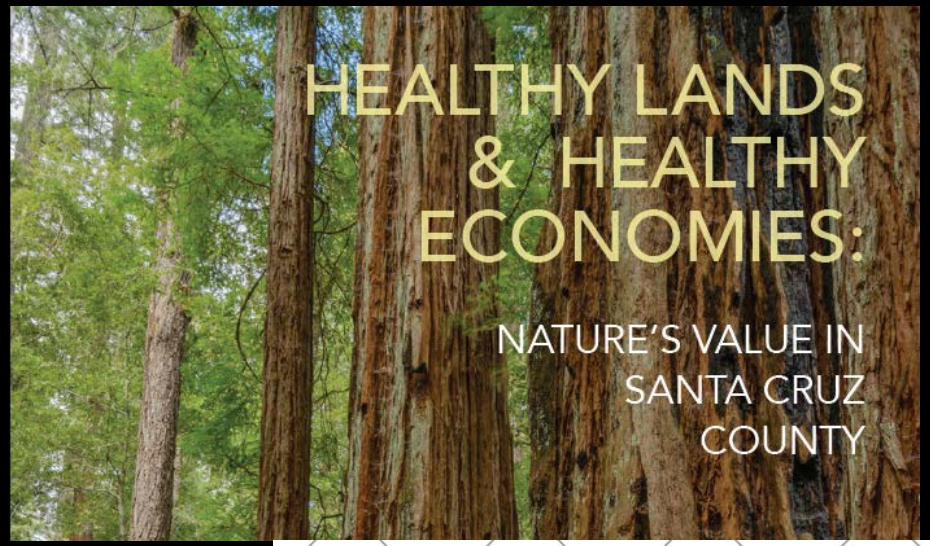
Successful management will require the establishment of useful goals & objectives for ecosystem services;

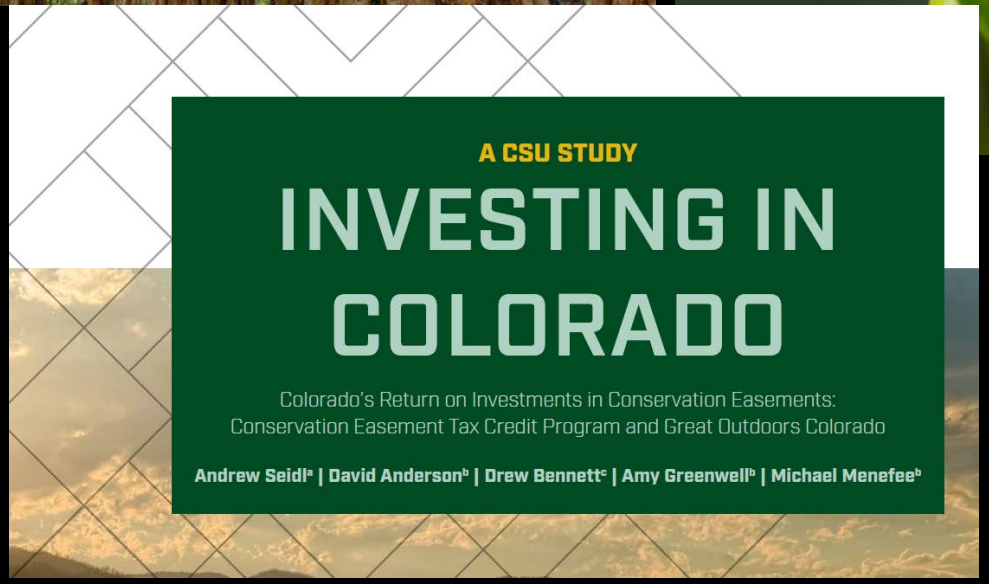
Baseline data;

Detect change on the land that may be due to management actions or disturbances;

Science based management practices that improve ecosystem services;

Programs that provide incentives to promote or protect working private lands.





ROI= ~ 6:1 But no development of counterfactuals

Ecosystem Services & Land Use Change

- Imagine a scenario where we want to preserve rangelands from converting to wine grapes, almonds, houses
- After three years, net revenue above cost is over $3000 and acre for wine grapes in some areas of California!
- Similar reality exists for land use change to almonds and to residential development
- Can we reasonably expect the public to pay a rancher $3000 an acre to prevent conversion?
- Can PES be an effective tool to prevent land use change to high value agriculture and development?

Will anyone be paid for Ecosystem Services?

- Should we only be paying for additional services or should we be paying for what we are now getting for free?
- Unlikely to influence land use changes – particularly to almond, vineyard, or residential development
- ES payments are a good fit for changing management – especially for highly valued systems such as wetlands
- Who will lead this? Are there research gaps or implementation gaps?

Future Ecosystem Service Payment (PES) programs

Money Use

Ecosystem Services Investments

Land investment

Family & Personal Use

Ownership Changes

Generational investments

Increase programs to incentivize management practices

Satisfaction

Agricultural lands remain

Succession, ability to retain land in family

Increased habitat & reduce fragmentation

Next steps

Public education of Ecosystem Services

Development of ES White Paper

Develop Land Trusts Partnerships

Recognize management practices that impact Ecosystem Services

Provide science based information for policy changes

Invest in payment structures for Conservation Easements or other incentives for PES

Voluntary VS Regulated

Through Conservation Easements
Improve ecosystem function & economic incentives

Market Recognition

Payments for Ecosystem Services (PES)

Green labeling

Green investments

Voluntary Action

Increased acreage in conservation easements

Non agriculture / stewardship ethic

Regulatory Action

Reduce need for regulations

Reduce Climate Change Risk

THANK YOU – QUESTIONS

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