Rangeland Ecosystem Services

1) Provisioning services

- Food
- Fiber
- Fuel
- Biochemicals (*plant chemicals make up the basis of over 50% of all prescription drugs)*

Rangeland Ecosystem Services

2) Supporting services

- Water cycling

85% of the drinking water in California comes from rangeland watersheds

Watershed Ecosystem Services

Watershed Function

- Capture and release
- Water storage
- Filtration
- Infiltration rate under moderate grazing
  - 80 in/ h oak woodlands
  - 8 in/h open grasslands

Dr. Tate's lab at UC Davis

Rangeland Ecosystem Services

- Wildlife Habitat
  - 500 rare plant species
  - Grasslands provide habitat for 90% of rare and endangered species

Ferruginous hawk (*Ferruginoushawk.org*)

Rough-legged hawk (*Eastside Audubon*)

Praire falcon (*Hawquest.org*)

- Several diurnal raptor species have positive associations ONLY with grassland habitats
- Prefer grazed over ungrazed grasslands

Pandolfino et al 2011

Amphibians

- **California Tiger Salamander** and **Red-Legged Frog**

- Stockponds in Bay area provide 50% of the habitat (FWS)

Mammals

San Joaquin Kit Fox

Bat Conservation

Ranches are good for bats too…

Dan Taylor Bat Conservation International

Bats and Ecosystem Services

- Bats are primary predators of night-flying insects that cost farmers and foresters millions of dollars annually
- Water is a key limiting factor for bat populations in arid rangelands

Dan Taylor Bat Conservation International

Umbrella Species

The Panther is an Umbrella Species; when we protect the Panther, we protect all our neighbors! Credit: Steve Carboi

"A species whose home range and habitat requirements are sufficiently broad that, if protected, numerous other species of smaller range will also be protected"

Ranchers as Umbrella Species

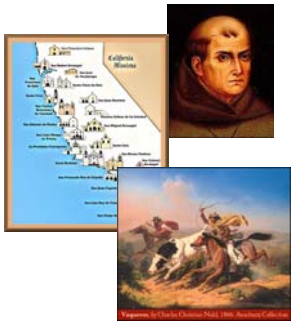
Protecting ranchers to protect species

Grazing and Ecosystem Services

- Grazing as management tool
  - Invasive species control
  - Fuel load reductions
  - Vernal pools
  - Wildlife habitat
  - Recent research

Spanish Period (1769-1822)

- Introduction of non-native plant and animal species:
  - -Intentional
  - - Accidental



Total Vegetation Conversion

Native perennial grasslands

Drought
Cultivation
Overgrazing
Other?

Non-native annual grasslands

California Rangelands

Key to understanding ecology and management:

- **Dominant annual non-native grasses**
- **Highly invasible**

Tools for Management

- Mowing
- Burning
- Spraying
- Grazing

No management = reduced biodiversity

Grazing Vernal Pools

- Increased biodiversity (↓non-natives, ↑natives)
- Reduced evapotranspiration + soil compaction = water stays in the pools longer
- Invertebrates (Fairy shrimp and tadpole shrimp are able to complete their life cycle

Keystone Species

www.kelewis.com

"A keystone species is a species that exerts an impact on its community that is both strong and disproportionate to its abundance."

Cows as Keystone Species

Ranchers as Keystone Species

Removing ranchers from the land can have detrimental effects to rangeland ecosystems

Lange's Metalmark Butterfly Antioch Dunes

- Habitat fragmented by large-scale sand mining and industrial development
- Feeds on buckwheat and other natives
- Nonnative grasses and vegetation encroached on the sand dunes
- US Fish and Wildlife Service/UCCE are using grazing to control nonnative vegetation

Ohlone Tiger Beetle Santa Cruz County

- Needs low, spare vegetation with open spaces to forage and lay eggs
- Improving habitat by grazing?
- Research project under way (Larry Ford, Devii Rao and Dick Arnold)

Swainson's Hawk/ UC Davis

- Needs opens grasslands
- Improving habitat by grazing?
- Project under way (Andrew Fulks and UC Davis Animal Science Department)

Oak Regeneration

Riparian Areas

Rangeland Ecosystem Services

- Wild pollinators provide $937 million to $2.4 billion per year to California agriculture.
- California rangelands, provide 35-39 % of all pollination "services" to the state's crops.

Rangeland Ecosystem Services

Adaptation to Climate Change

- Carbon sequestration
- Connectivity

Rangeland Ecosystem Services

D) Cultural services

- Education
- Knowledge systems
- Recreation
- Open space
- Spiritual, well-being

Ecosystem Services and Rangeland Conservation

- Public benefits
- Externalities
- Lack of incentives for ranchers to provide ecosystem services

Ecosystem Services and Rangeland Conservation

- Loss of ranchers
- Loss of rangelands

- Loss of ecosystem services

Ecosystem Services and Rangeland Conservation

- Helps with outreach

- More efficient and effective conservation
- Create incentives for rangeland conservation through payments/markets

Summary

- California Rangelands provide multiple ecosystem services to society
- Ranching and grazing are an essential component of rangeland ecosystems

How can we find incentives to maximize the provision of ecosystem services and keep ranchers ranching?