Practices to Enhance Ecosystem Service Production and Tradeoffs, Current and Future
K.W. Tate and L.M. Roche – UC Davis

http://rangelandwatersheds.ucdavis.edu
Goals, and thus, **best** management practices have changed over time

“Grasses, not oaks, make your cows fat”

UCCE – 1960’s
Managing for Agricultural Productivity

Oak and shrub thinning was, and is, a common practice to increase forage production.

<table>
<thead>
<tr>
<th>acre/AUY</th>
<th>oak thinning</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>Intact oak woodland</td>
</tr>
<tr>
<td>13</td>
<td>thin to 30% oak cover</td>
</tr>
<tr>
<td>7</td>
<td>thin to 0% oak cover</td>
</tr>
</tbody>
</table>

UC SFREC Stocking Records 1999-2009
Oaks, shrubs important to maintaining ecosystem services – balance forage increase w/ conservation

<table>
<thead>
<tr>
<th>Metric</th>
<th>Grassland</th>
<th>Oak Woodland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total N</td>
<td>2.5 g/kg</td>
<td>3.6 g/kg</td>
</tr>
<tr>
<td>Total C</td>
<td>30 g/kg</td>
<td>52 g/kg</td>
</tr>
<tr>
<td>Infiltration</td>
<td>20 cm/hr</td>
<td>218 cm/hr</td>
</tr>
<tr>
<td>Diversity</td>
<td>1.64</td>
<td>2.05</td>
</tr>
</tbody>
</table>
NOW: Manage for many outcomes, not just one, nor one at a time

Forage and Livestock Production
Weed Control – Diversity
Wildlife and their Habitat
Productive and Healthy Soils
Water Quantity and Quality
A Scientific Assessment of the Effectiveness of Riparian Management Practices

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40 scientists reviewed research base supporting effectiveness of NRCS rangeland conservation practices

Research to support many of the practices

Focus on single practice and single outcome

Difficult to extrapolate to ecosystem or ranch scale

Need – ranch enterprise scale research on adaptive, integrated implementation of practices for multiple outcomes.
Example: Grazing & Microbial Water Quality

A tool box of practices exists

Factors that increase risk of water pollution with pathogens

- High stocking rates
  - more fecal load
  - more defecation in water, near water, and runoff areas
  - more runoff and pathogen transport

- Herd infected
  - calves < 4 mo
  - calving during rainy season
  - long calving season

- Distribution - space
  - cattle defecate in water
  - cattle defecate near water
  - cattle defecate in runoff areas

- Distribution - time
  - cattle defecate near water during rainy season
  - cattle defecate in runoff areas during runoff

Practices that reduce risk of water pollution with pathogens

- Moderate Grazing
  - set cattle numbers in balance with forage production
  - enhance soil hydrologic health

- Manage Calving
  - keep calves < 4 mo away from water
  - offset calving from rainy season
  - shorten calving season

- Manage Cattle Distribution
  - provide off-stream water
  - place supplemental feed away from water and runoff areas
  - create riparian/runoff pastures
  - create buffer strips

- Manage Grazing Time
  - reduce cattle grazing near water during rainy season
  - reduce cattle grazing in runoff areas prior to and during runoff

Tate, Atwill, et al.
Build riparian pasture

Build riparian pasture

What will it cost?

Distribute supplemental feed

Moderate stocking

How effective will the investment be?

Effective for other goals?

How do I prove it is effective?

How do I get return on the investment?
Learning at the management scale

*Survey of 130 Grazed Riparian Areas*

- Streams across CA ranging from excellent to poor health.
- Which practices are associated with excellent and poor health?
Practices and Riparian Health

- Off-stream attractants such as water tanks and supplementation – days/yr (+).
- Herding to control utilization and time spent in riparian area – days/yr (+).
- Rest period duration – days/yr (+).
- Cattle density (cows/ac) during grazing bouts (-).
- Frequency of grazing bouts per year (-).
Managing for Services

- Ecosystem services must be a goal.
- A big tool box exists, no magic bullet.
- Site specific, adaptive management.
- Flexibility to make changes.
- Logistically and economically feasible.
- Integrated into overall ranch plan.
Investment (capital and time) may be the major determinant of management effectiveness.

Not just the arrangement of tools in time and space......
Tradeoff: How does the ranch enterprise cover added operating costs and/or lost beef revenues?

UCD/CCA Williamson Act Survey - 49% own less than 1000 ac; 64% ranch part-time, 68% lease additional land; mean enterprise is 3041 ac; mean age 63.
**Tradeoff:** How does the ranch enterprise cover added operating costs and/or lost beef revenues?

- Market ecosystem services
  - Carbon, water quality, habitat, etc.
  - EDF/CCA Survey “most ranchers don’t know what services are, but most are willing to be paid for them”
- Reduce regulatory compliance costs
  - Feather River Watershed from $50K down to $10K/yr
- Public investment: USDA cost share programs
- Still need more alternatives
Research Community

Conduct more research at the enterprise scale

Interdisciplinary - multiple outcomes

Incorporate manager knowledge - collaboration
Prescribed Grazing to Restore Rangeland Soil Quality, Plant Diversity, Water Quality, and Agricultural Productivity

K.W. Tate, L.M. Roche, V.T. Eviner, A.T. O'Geen, J.D. Derner, M.N. Lubell, and M.R. George, B.B. Cutts, A.V. Robertson
Mail survey to 2000 CA and WY ranchers

Knowledge about grazing to achieve both agricultural and ecological goals

Information needed to manage for goals

Best way to provide information

Coming this winter...
Rangeland Decision-Making Survey

We invite California ranchers to tell us about factors that affect livestock and land management.

Participating is a chance to...
- Assure university science is useful and useable
- Discuss the practices and policies that affect your business
- Help communicate the priorities of ranchers to agencies and the legislature

Visit http://environmentalpolicy.ucdavis.edu/projects
Mail survey to 2000 CA and WY ranchers

On ranch survey of practices and ecosystem service
Mail survey to 2000 CA and WY ranchers

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3000 ac adaptive grazing management study SFREC
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Develop on-line decision support and learning tool – for both us and managers!