
Rangeland Management: Assessing the Past to Create the Future

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Presentation Objectives

Previous management approaches

- Limited effectiveness in past
- Inappropriate for emerging challenges

Alternative management approaches

- Human-ecological systems
- Adaptive management and learning
- Local communities of practice

Future management agenda

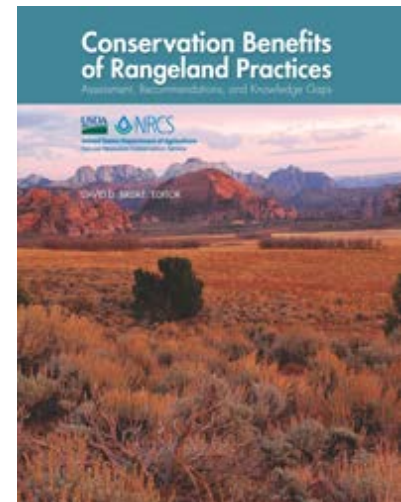
- Anticipate and manage change

Information Sources

“Big Questions in Rangeland Management”
 Rangeland Ecology & Management
 65(6) November 2012

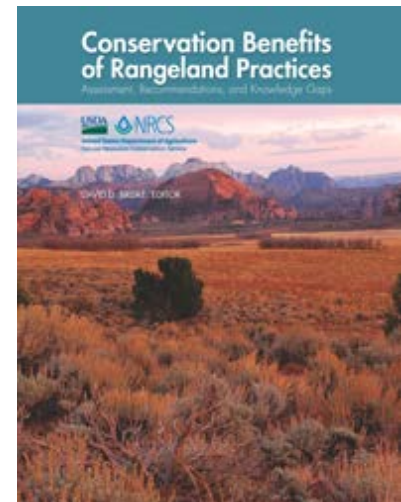
Contribution of **75** scientists, **40**
 USDA personnel and **65** reviewers

Conservation Benefits of Rangeland Practices
 USDA Natural Resource Conservation Services
 January 2012



Record of Past Success

- Science-management-policy partnerships
 - ✓ Science – management – policy gaps
 - ✓ Minimal policy-relevant science
- Monitoring management outcomes
 - ✓ Limited learning from past management
 - ✓ Little support for adaptive management
 - ✓ Centralized management policies
- Human-ecological systems
 - ✓ Unrecognized and under appreciated
 - ✓ Essential to natural resource management



Similar Policy Problems Persist

- Short-term decisions override long-term decisions
 - ✓ Willingness to discount the future
- Competitive behavior wins over cooperation
 - ✓ Power and money valued over sustainability
- Diverse interests and values of society
 - ✓ Extreme views limit meaningful communication
- Fragmented authority and knowledge
 - ✓ Absence of responsibility and relevant information

(Yaffee 1997)

Steady State Management Model

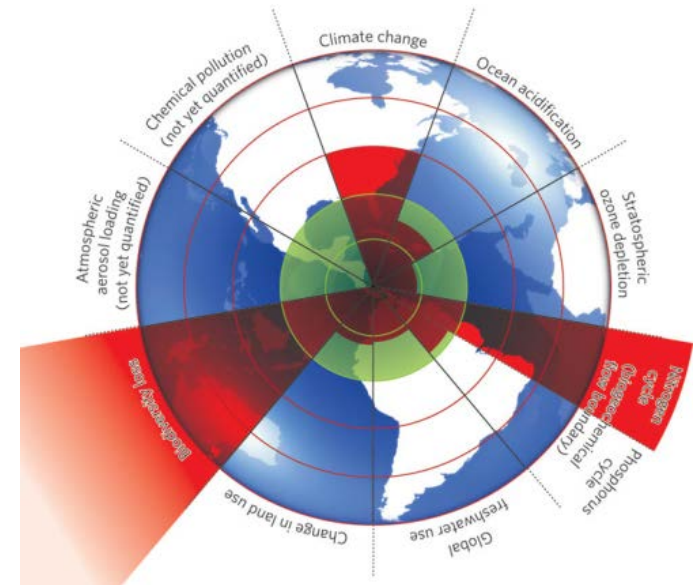
- Steady State Model
 - ✓ Maximum sustainable yield of one or two services
 - ✓ Control variability in other parts of the system
 - ✓ Subsidize production if necessary
- Model Limitations
 - ✓ Competition between maximum yield and sustainability
 - ✓ Difficult to maintain maximum yield
 - ✓ Little margin for management error or extreme events
- Policies reflect this narrow management model

Limitations of Science

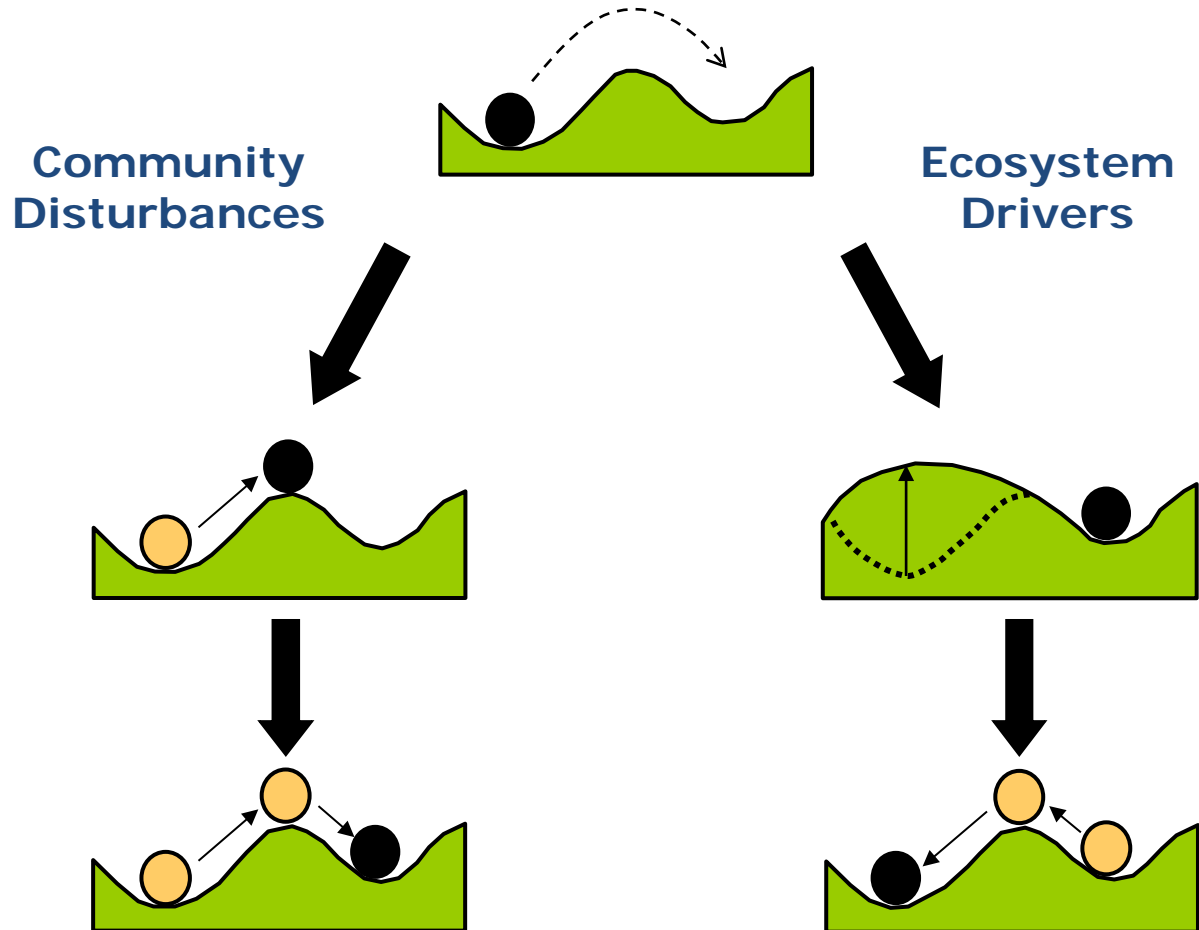
- Goal to increase understanding **not** decision making
 - Precision rather than relevance
- Focused on specific ecological processes at few locations and over short periods
 - Plant production, species composition, soil carbon
- Management and policy constraints are often underappreciated by scientists
- Much science is inappropriate for management and policy decisions

Tremendous Change Has Occurred

- **Anthropocene** - new planetary epoch associated with human-induced changes to Earth.
 - Climate change
 - Human population growth
 - Globalization
 - Land cover change
 - Invasive species
 - Nitrogen eutrophication
- Previous management models and policies may **not be effective** in the future.

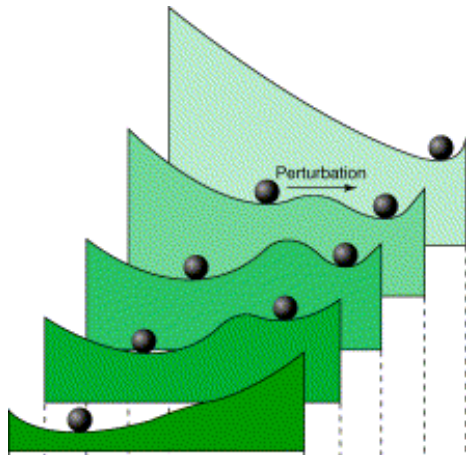


Ecological Resilience

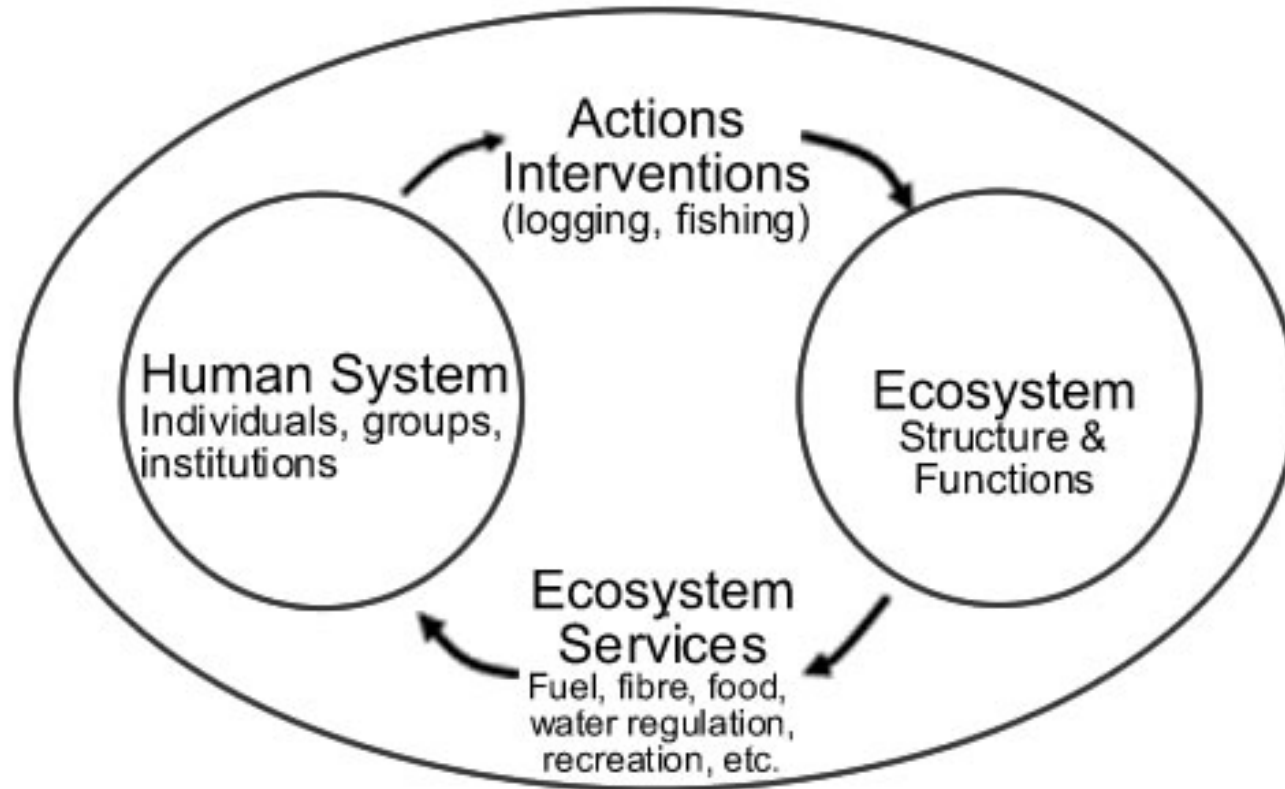


Resilience Difficult to Apply

- Thresholds recognized after they occur
- Indicators of resilience not well developed
- Critical triggers poorly understood
- Time for threshold conditions to form unknown
- Application to human-ecological systems limited



Human-Ecological System



Comprised of inter-dependent physical, biological and social components that affect system behavior.

Intensive Rotational Grazing Debate

Science inconsistent with management perceptions

- Experimental grazing research
 - ✓ Rigorously investigated topic with consistent data
 - ✓ Ecological benefits of intensive rotational grazing minimal
- Why has the debate persisted?
 - ✓ Ecological variables and processes emphasized
 - ✓ Adaptive management excluded
- Emphasizes need for a social-ecological approach
 - ✓ Collectively evaluate management and ecological process

Resilience-based Management

Strategies that support human livelihoods by maintaining the supply of ecosystem services in change conditions.

- Anticipate and guide change to benefit society
- **Mitigation** – reduction of exposure to disturbance or stress.
- **Adaptation** – social or economic adjustment to minimize harm and capture opportunities.
- **Transformation** - major change that creates a new social-ecological system with different livelihoods and management.

Resilience Human-ecological Systems

Three broad components of resilience in H-ES:

- Ability to absorb disturbance and maintain function while undergoing change
- Capability to reorganize following disturbance
- **Capacity to learn and adapt to new conditions**
 - ✓ Under direct human control
 - ✓ Emphasize adaptive management and social learning
 - ✓ Implement within local ‘communities of practice’

Adaptive Capacity & Management

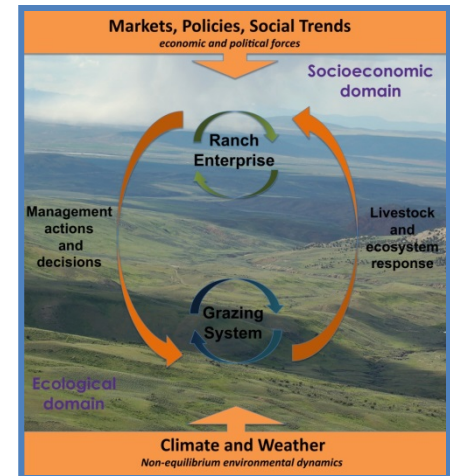
Build capacity to sustain resilience by collective learning

- Shared management objectives and research questions
- Design practical and scientifically valid management plans
- Collaboratively interpret monitoring results and outcomes
- Modify current management to effectively achieve goals
- Multiple stakeholder involvement from the outset



Adaptive Management Challenges

- Who's responsibility is it?
 - ✓ Authority and coordination
 - ✓ Funding and planning
 - ✓ Information storage and management
 - ✓ Peer review, publication and distribution
- Complexity of human decisions underappreciated
 - Fire in ecosystems
 - Climate change
 - Livestock grazing



Future Management Needs

➤ Ecosystem Services

- Assessment, Monitoring and Valuation
 - Especially those without market value
- Managing tradeoffs among groups of services
 - Water yield and biodiversity
 - Livestock versus biodiversity

➤ Spatially Explicit Planning

- Recognize heterogeneity and variability
- Systems needed to record and apply spatial information
 - Averages and individual site descriptions have limitations

New Management Agenda

- Produce greater partnerships and relevant management knowledge to support resilience-based management.
 - ✓ Critical assessment of the limits of scientific knowledge
 - ✓ Agenda more inclusive of human and social considerations
 - ✓ Strengthening partnerships between management, science and policy institutions
 - ✓ Promote learning and adaptation in local communities

