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Symposium

Confronting the Management – Science Knowledge Gap to Support Natural Resource Management.

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Knowledge Sources, Flows and Challenges

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Sustainable Rangelands

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Knowledge Application

- **Mission statement of SRM**

  "Stewardship of rangelands based on ecological principles"

- **Goal Rangeland CEAP**

  "Strengthen the scientific foundation underpinning USDA-NRCS conservation programs"

- **Provenza 1991 JRM**

  "Range science and management are complementary, but distinct endeavors".

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Major Knowledge Sources

- **Management** – experiential, derived from learning by doing often to provide livelihoods.
- **Scientific** – experimental, concepts developed by scientific methods to describe ecological processes.
  - ✓ **Information** - organized data with specific purpose; readily transferred to others.
  - ✓ **Knowledge** - blend of experience, values, and intuition, in addition to information; difficult to transfer to others.

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Assumptions of Knowledge Exchange

Management and scientific knowledge are both:

- Valid and necessary
- Readily exchanged
- Presumed to support one another

What assumptions do have for exchange of management and scientific knowledge?

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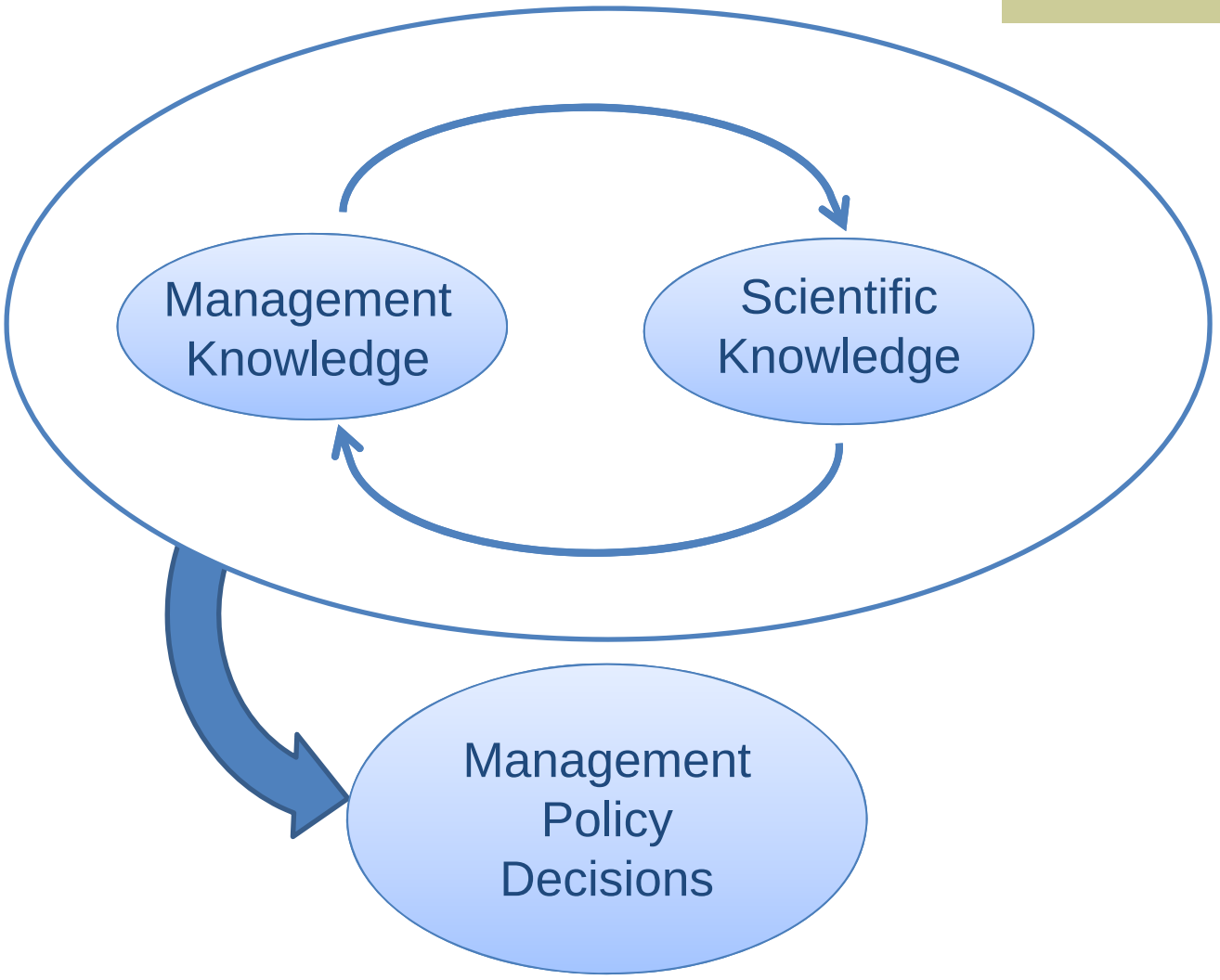
What is Your Mental Model?



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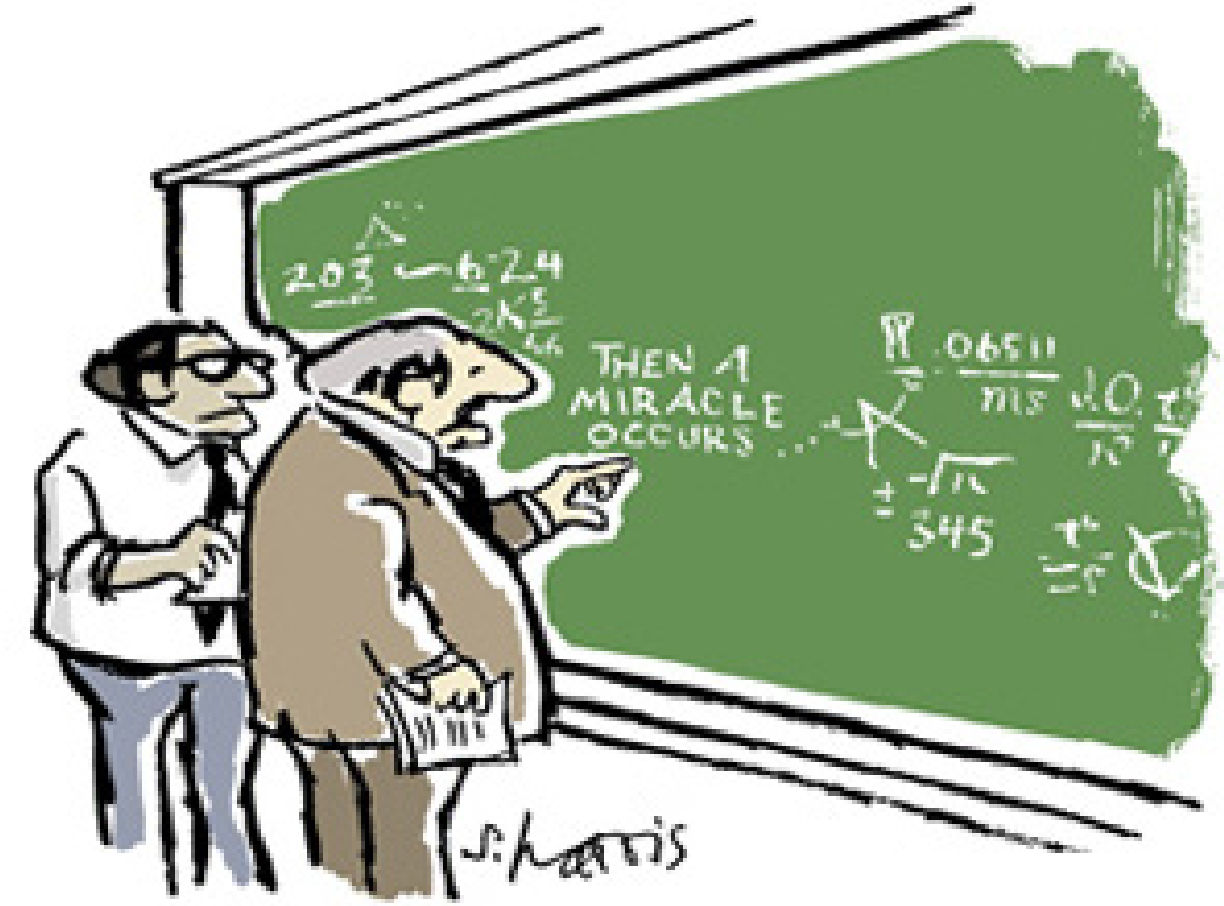
“And Then a Miracle Occurs”



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Knowledge Exchange is Limited

- Representatives of each knowledge source disparaging the other.
- Minimal use of scientific knowledge in conservation management decisions.
- Rangeland CEAP identified barriers to knowledge exchange.

Managers > scientific knowledge abstract & irrelevant.

Scientists > management knowledge imprecise and unreliable.

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The ‘Miracle’ May Not be Occurring

- Few procedures exist to exchange knowledge.
- Should we develop specific approaches to exchange knowledge sources?
- What approaches may be most effective?
- What outcomes do we expect from this exchange?

This challenge will not be resolved today, but explicit problem identification will hopefully initiate the process.

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Knowledge Source Comparison

Knowledge Attribute	Management knowledge	Scientific knowledge
Source	Tradition, direct experience, dependence on resource, community knowledge,	Experimentation, peer review, scientific publication, scientific community
Objective	Support human livelihoods and sustain natural resources	Understand processes and dynamics in physical and social systems
Strengths	Place-based, holistic, relevant to livelihoods, long time frames	Critical, objective vetting of truth claims, explicit documentation, transferable
Weaknesses	Difficult to communicate, limited documentation, inappropriate causation	Abstract, reductionist, poorly communicated, questionable management relevance

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Knowledge Sources are Distinct

Differences between them are to be expected.

- Developed by different actors.
- Intended to achieve unique goals.
- Rely on distinct forms of human cognition.

Uncertainty and conflict are potential outcomes.

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Knowledge Source Interactions

Management Knowledge	Scientific Knowledge
Correct	Correct
Incorrect	Correct
Correct	Incorrect
Incorrect	Incorrect

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Knowledge Exchange is Difficult

Knowledge is diffuse and difficult to categorize and communicate to others.

Application occurs in complex adaptive systems:

- Spatial and temporal scale
- Ecosystem type and heterogeneity
- Management goals and approaches
- Legacies of prior land use

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Management Correct: Science Incorrect

Carbohydrate reserves as indicator of plant vigor.

- High reserves ensured rapid regrowth from grazing.
- Role of C reserves invalidated in late 1980's.
- Replaced by stubble height to serve similar purpose
  - ✓ Retain leaf area and meristems to support regrowth.

Incorrect causation of a valid management goal.

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Science Correct: Management Incorrect

Shrub removal increases water yield.

- Removal reduces leaf area and transpiration.
- Surplus water recharges surface and ground water.

Removal increases grasses, leaf area and transpiration.

- Little or no additional water recharge results.

Over simplification of ecological processes.

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Both Source Incorrect

Difficult to verify because no valid reference.

- Effectiveness of shrub control procedures
- Importance of seeding following wildfire
- Reliance on practices instead of adaptive management

Opportunities for explanation and understanding.

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Both Sources Correct

Agreement among two knowledge sources.

- Stocking rate drives grazing responses
- Vegetative covers influences soil surface hydrology
- 'Nutritional wisdom' of ruminant herbivores

Knowledge sources confirm each other.

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Both Sources Correct: Different Reasons

Intensive rotational grazing debate

- Management correct in that IRG may facilitate planning and adaptive management.
  - ✓ Forage inventory, timely decision making, greater efficiency
- Science correct in that IRC does not dramatically increase ecological processes.
  - ✓ Plant and livestock production, surface soil hydrology, soil organic carbon

Strong justification for increased knowledge exchange.

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Exchange of New Knowledge

- Simultaneous, but **independent** application of both knowledge sources to a common goal in an experimental setting where outcomes are monitored.
- Simultaneous, **interactive** application of both knowledge sources to a common goal to produce a **hybrid** knowledge source.
- What other approaches may exist?

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Exchange of Existing Knowledge

Framework to promote learning from existing knowledge sources by explicit comparison of:

- Objectives and goals
- Assumptions and context
- Supporting evidence
- Spatial and temporal scales

Goal is not to eliminate differences or select the best source, but to learn from the exchange.