

Adaptation Strategies to Sustain Good & Services

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Climate Change Controversy



Al Gore



Jim Inhofe - Okla

- Uncertainty is omnipresent
- Not a justification for in-action
- Climatic variability is obvious
- Greater variability is anticipated
- **Professional responsibility to increase preparedness**

Climate Change Policy



Al Gore

House Bill April 2011

- Climate change is occurring
- It is caused by human actions
- Poses risks to human welfare

VOTE: 240 NO; 184 YES



Jim Inhofe - Okla

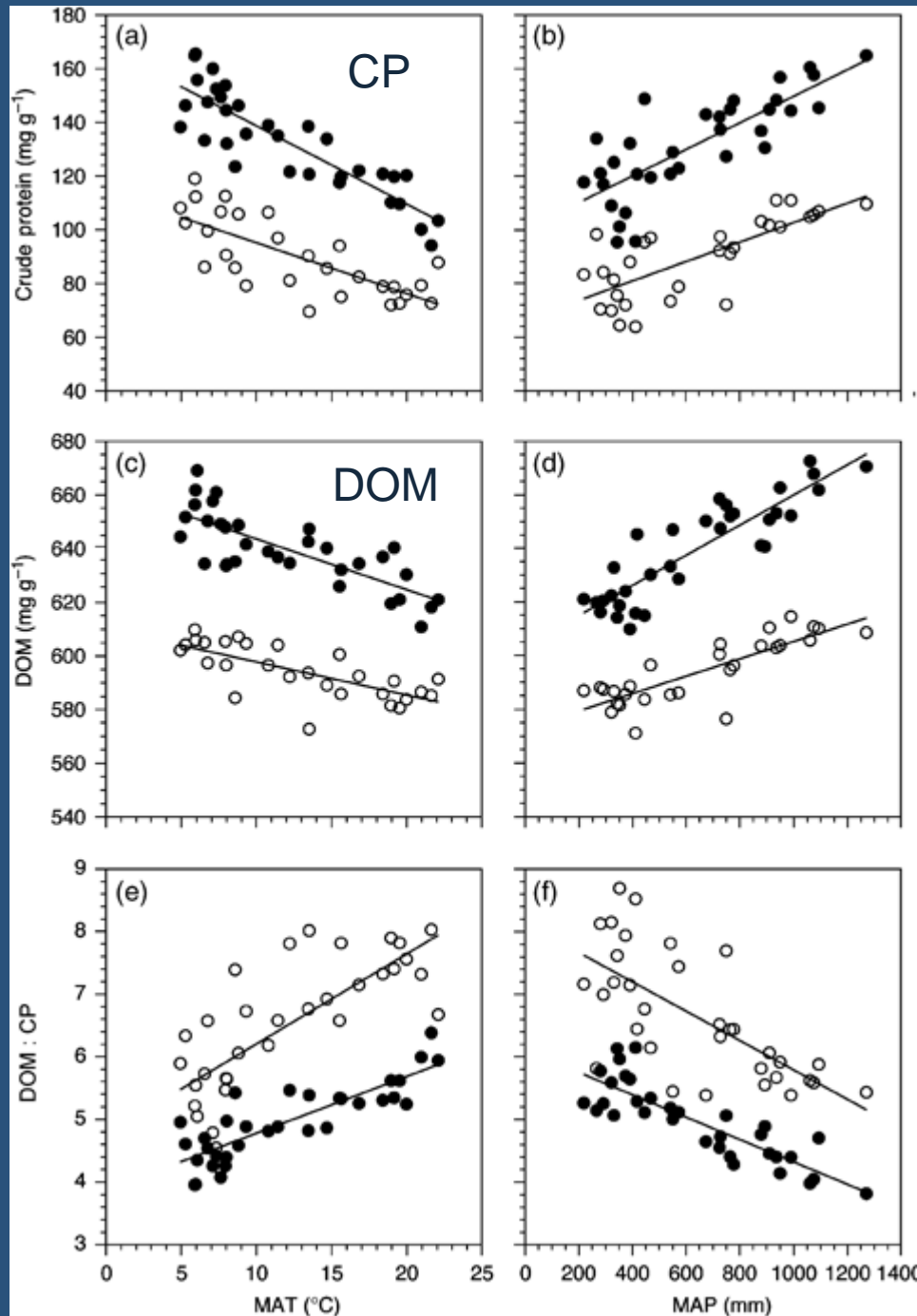
Select Climate Change Impacts



- Reduced forage quantity and quality
- Increased woody plant encroachment
- Elevated heat stress and parasite loads for livestock

Collectively challenge
enterprise viability





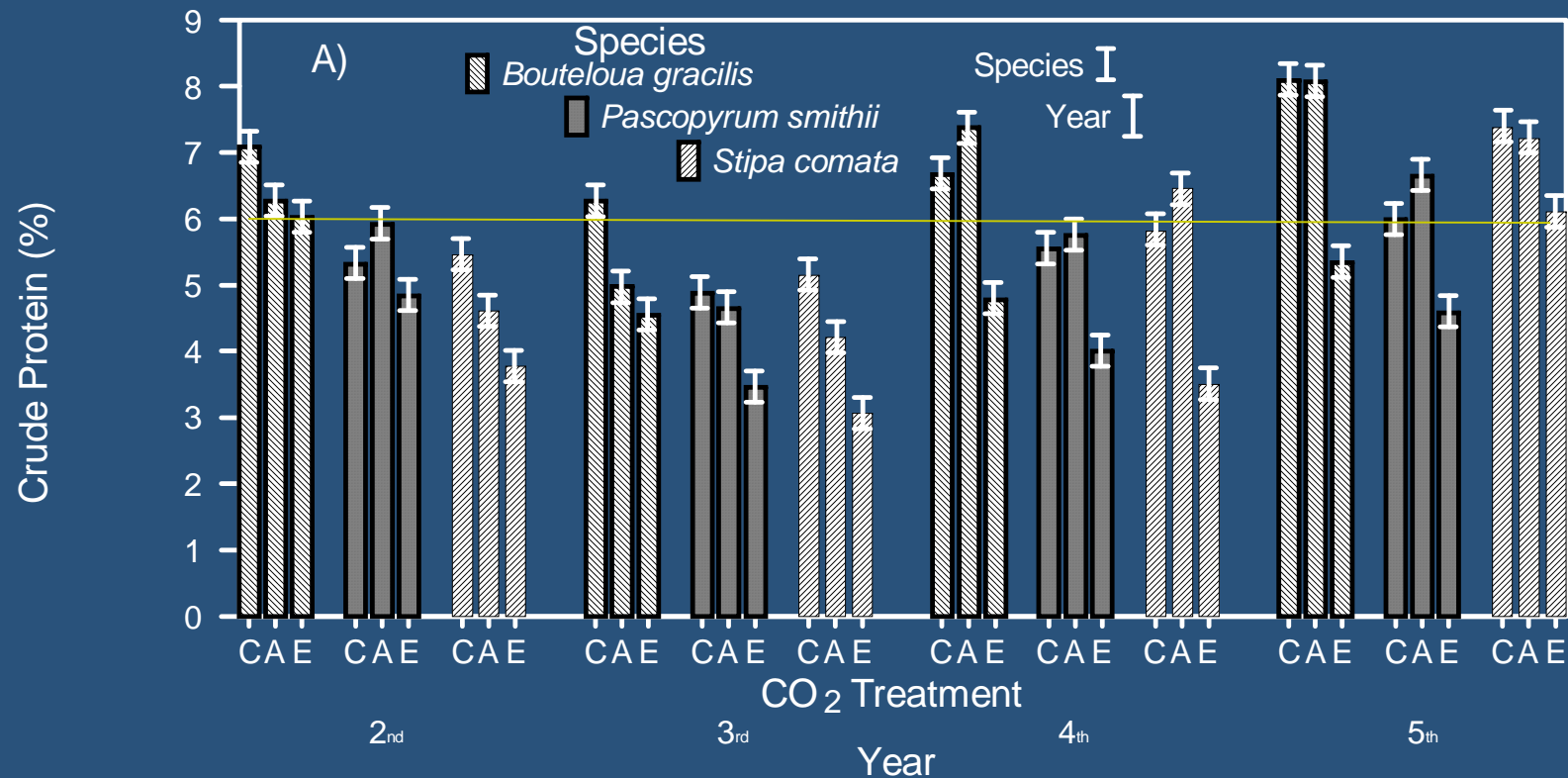
Forage Quality

- Annual Temperature
- Annual Precipitation



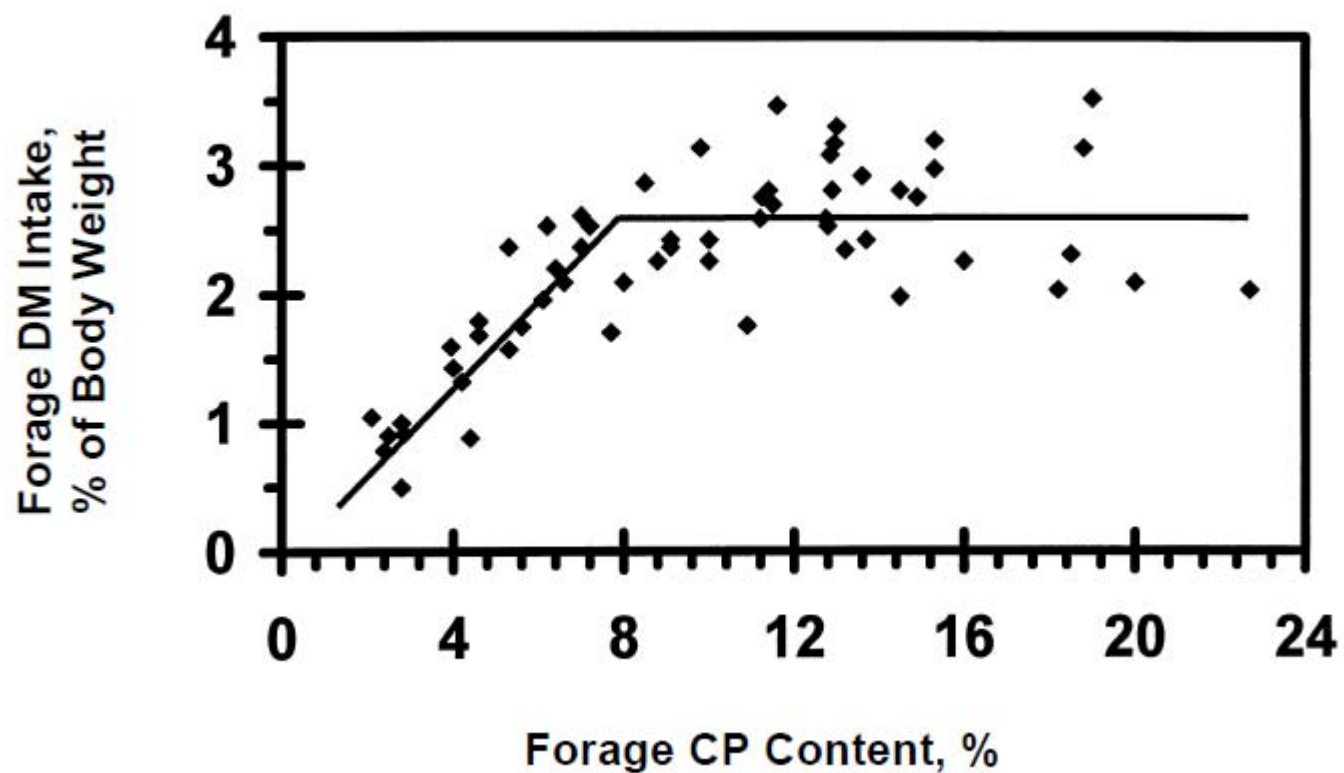
Craine et al. GCB 2010

Forage Quality in High CO₂

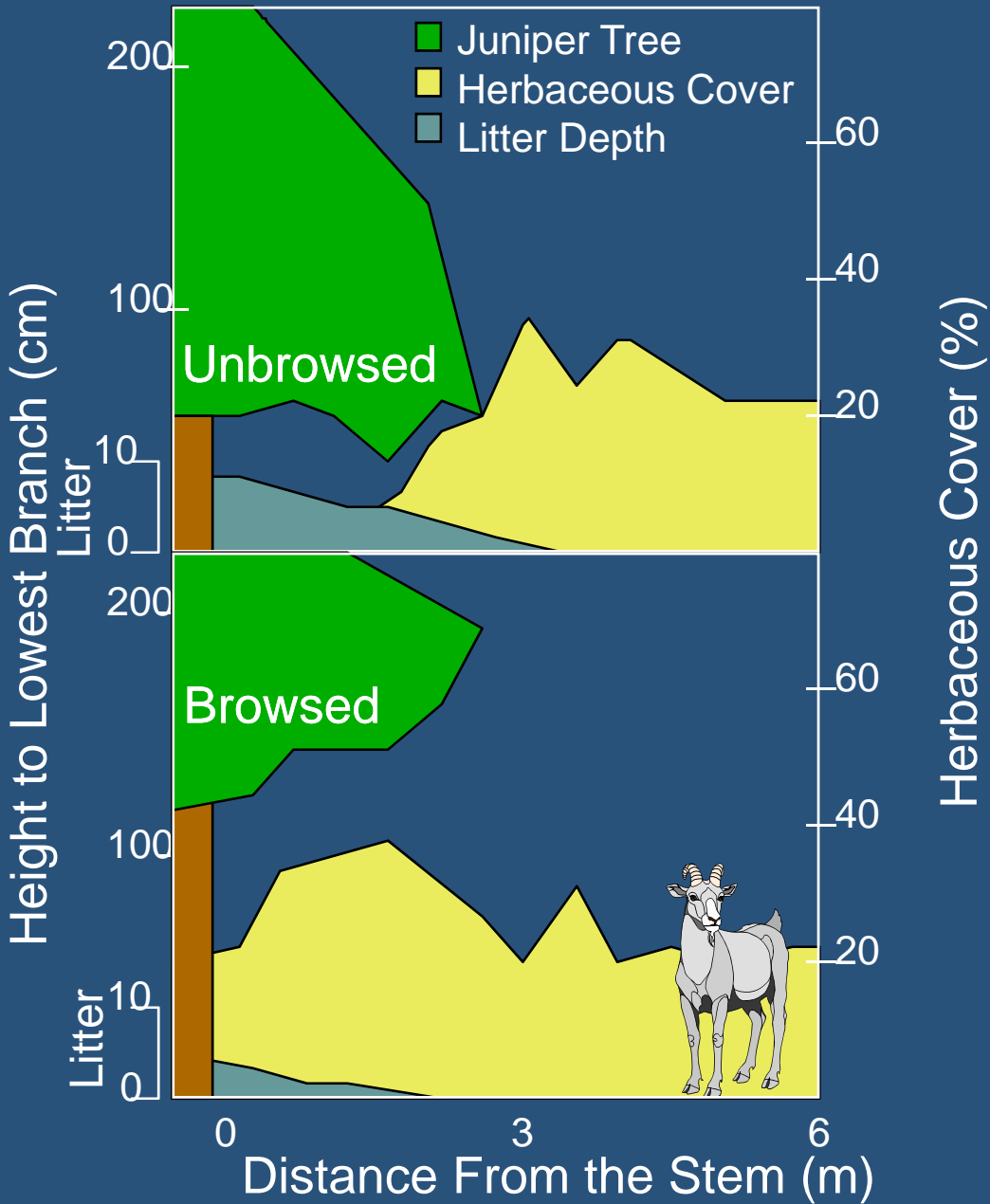


Decrease in forage quality will offset plant growth increases

Crude Protein vs Forage Intake



Mathis 2003



Fuhlendorf et al. 1997



Implications for Juniper Invasion



- Growth reduction to intensified drought offset by increased growth to warming.
- Moderate decline of C4 grass to intensified drought.
- **Juniper will likely increase** in warmer, drier climates, in the absence of fire.



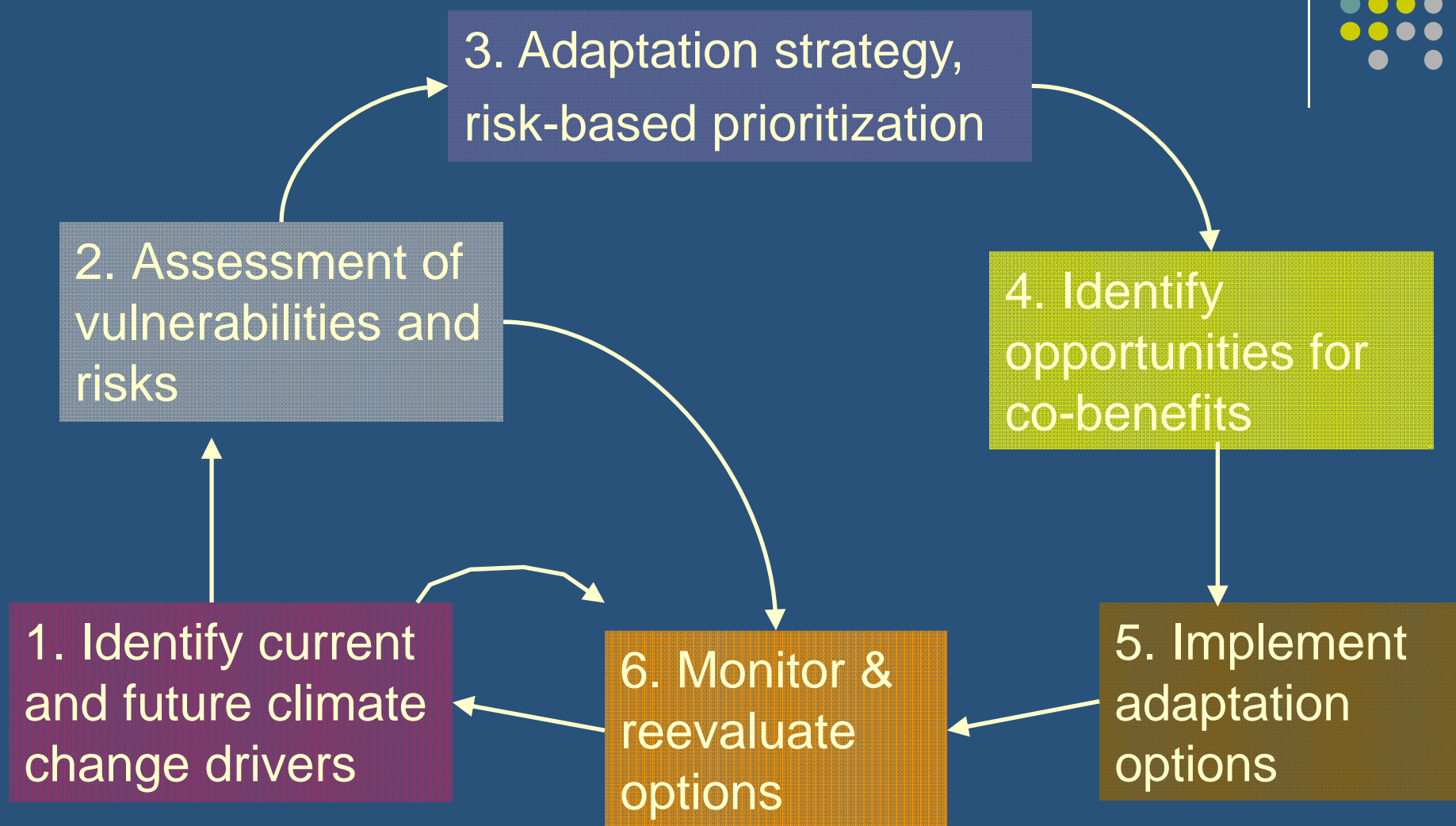
Volder et al. GCB 2010

Strategies to Offset CC



- **Adaptation** – modification of management practices and social systems to minimize negative impacts and exploit opportunities
 - Autonomous
 - Planned
- **Mitigation** – modification of management practices and production systems to reduce GHG emissions and sequester C.
- **Vulnerability** – potential for future harm.

Components of Adaptation



Currently Well Adapted?



Grazing Management Strategies

- Flexible grazing 2X > economic returns than does a set conservative strategy.
- Value of flexible grazing > with > climatic variability
- Yearlings in addition to cow-calf > economic gain
- Herd expansion with yearlings minimizes cost of flexible grazing strategies

Torell et al. REM 2010

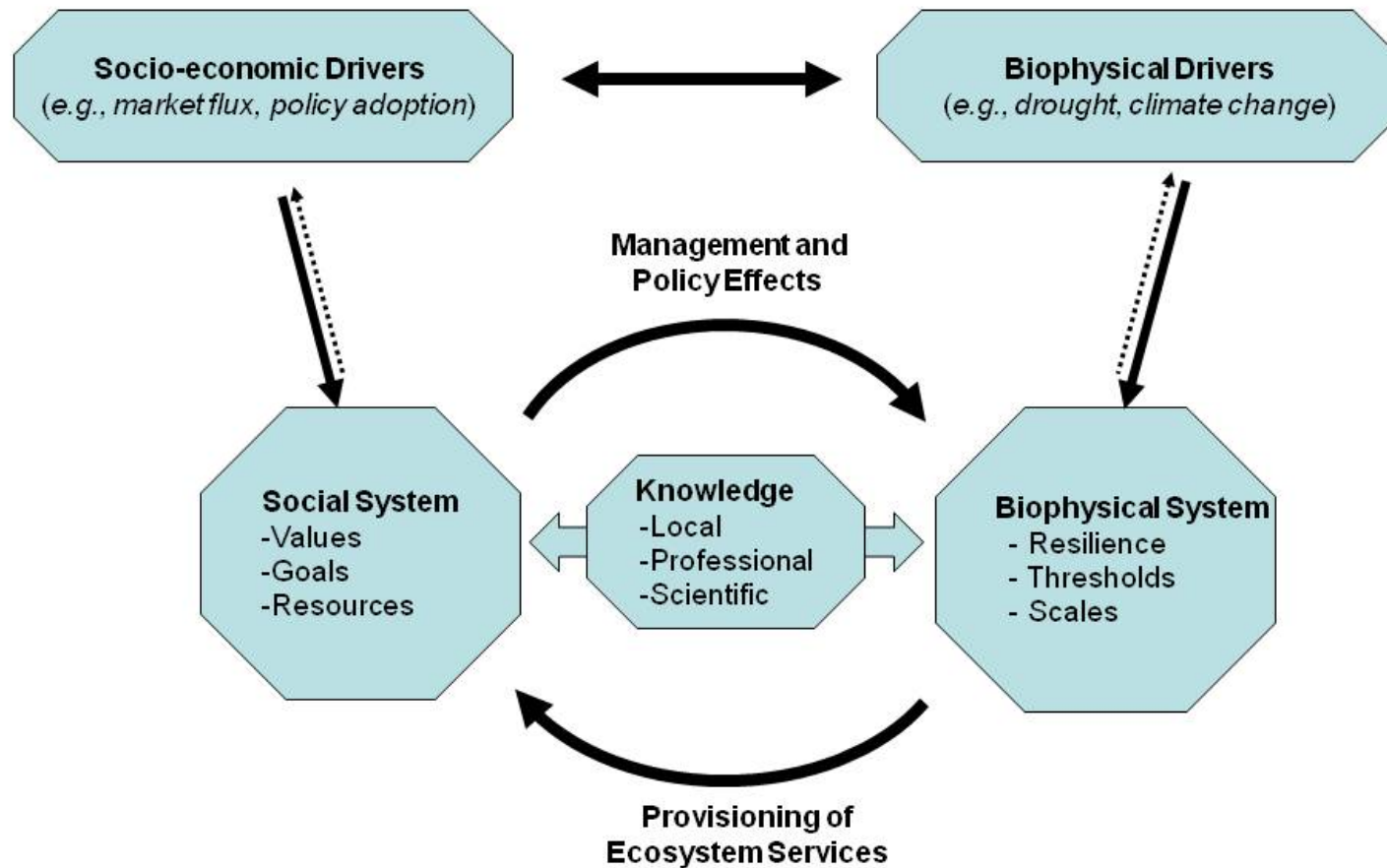
Adaptation Deficit



Drought Management Strategies

- 14% of 509 managers indicated preparedness; evidenced by 'crisis' federal relief, water development, livestock sales, and hay purchases.
- Majority caught in 'drought trap'
- 29% indicated > preparedness for 2009 drought; influenced by impact of earlier drought and belief that another was imminent.

Social – Ecological Systems



Layman & Stafford-Smith 2004

Vulnerability



- Degree to which a system is susceptible to, and unable to cope with, adverse effects of CC i.e., **measure of future harm**.
- Function of magnitude of CC impacts relative to sensitivity and adaptive capacity of the system.
- Can not be measured directly so **vulnerability indicators** must be used.
- **Prioritized ranking** of ecosystems and enterprises most likely to be harmed by climate change

Components of Adaptation



- Address **social** and **biophysical** change drivers
- Maintain or increase **future options**
- Promote **human capacity** to accept change
- **Synergy** between adaptation and mitigation
- Implemented **without** precise forecasts
- **Techno-fixes** useful in short-term, but address symptoms rather than causes.

Degree and Difficulty



Degree of adaptation

Minimal Moderate Extensive

Adaptation category

Human	Risk perception	Contingency planning	Anticipatory planning
Enterprise	Drought management	Diversify production	Alternative systems
Social	Participatory management	Alternative markets	Restructure organizations

Implementation difficulty



Human Capacity

Individual

- Perception of risk and uncertainty
- Willingness to change

Community

- Land ownership patterns
- Human demographics
- Social networks





Enterprise Adaptations

- Conservation/drought planning
- Supplemental feeding i.e., protein
- Stocking rates
- Cow body size
- Ectoparasite control
- Income diversification
- Use of novel communities



Enterprise Adaptations

- Livestock breeds and species
- Relocate production systems
- Alternative production systems
 - Ecotourism
 - Ecosystem services
- Fire policy – fuel management



Social Adaptations



- Institutional adaptive capacity
 - Anticipate and manage change
 - Participatory management
- Policy development
 - Farm Bill provisions
 - Drought assistance programs
- Markets to purchase alternative goods
- Markets for ecosystem services



Implementation



- Recognize that change is a certainty
- Reassess beliefs, management and policy recommendations
- Monitor to detect change and inform management and policy recommendations
- Organize participatory management-science-policy partnership
- What is the role of SRM?

