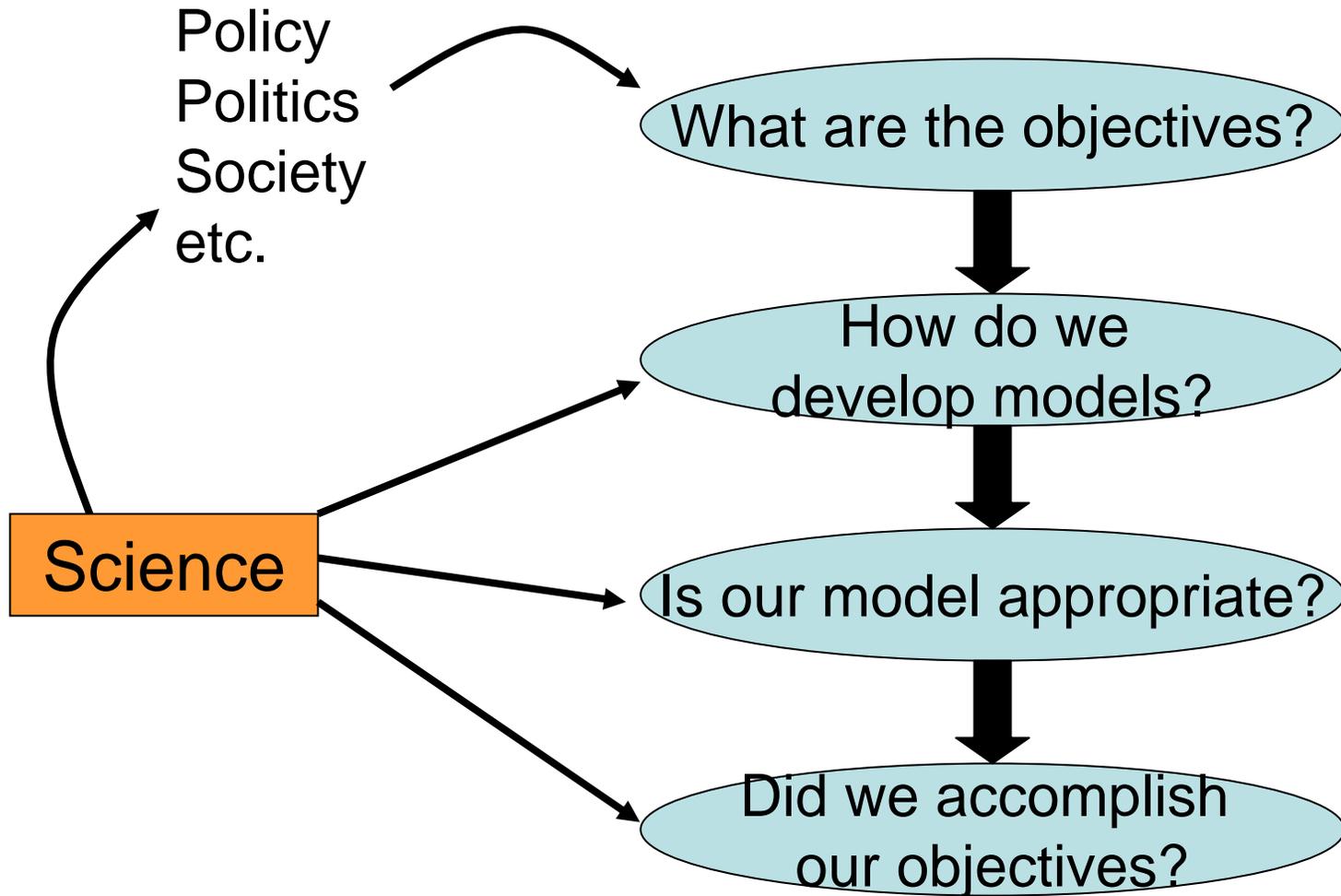


Evaluating S&T models and ESDs



What is/are the objective(s) and who is the target?

Agencies

- Communication Tool
- Repository for ecological information
- Assist land management
- Assist policy makers

Land Managers

- Livestock
- Biodiversity
- Wildlife management
- Water quality and quantity
- System resiliency
- Minimize accelerated erosion
- Etc.

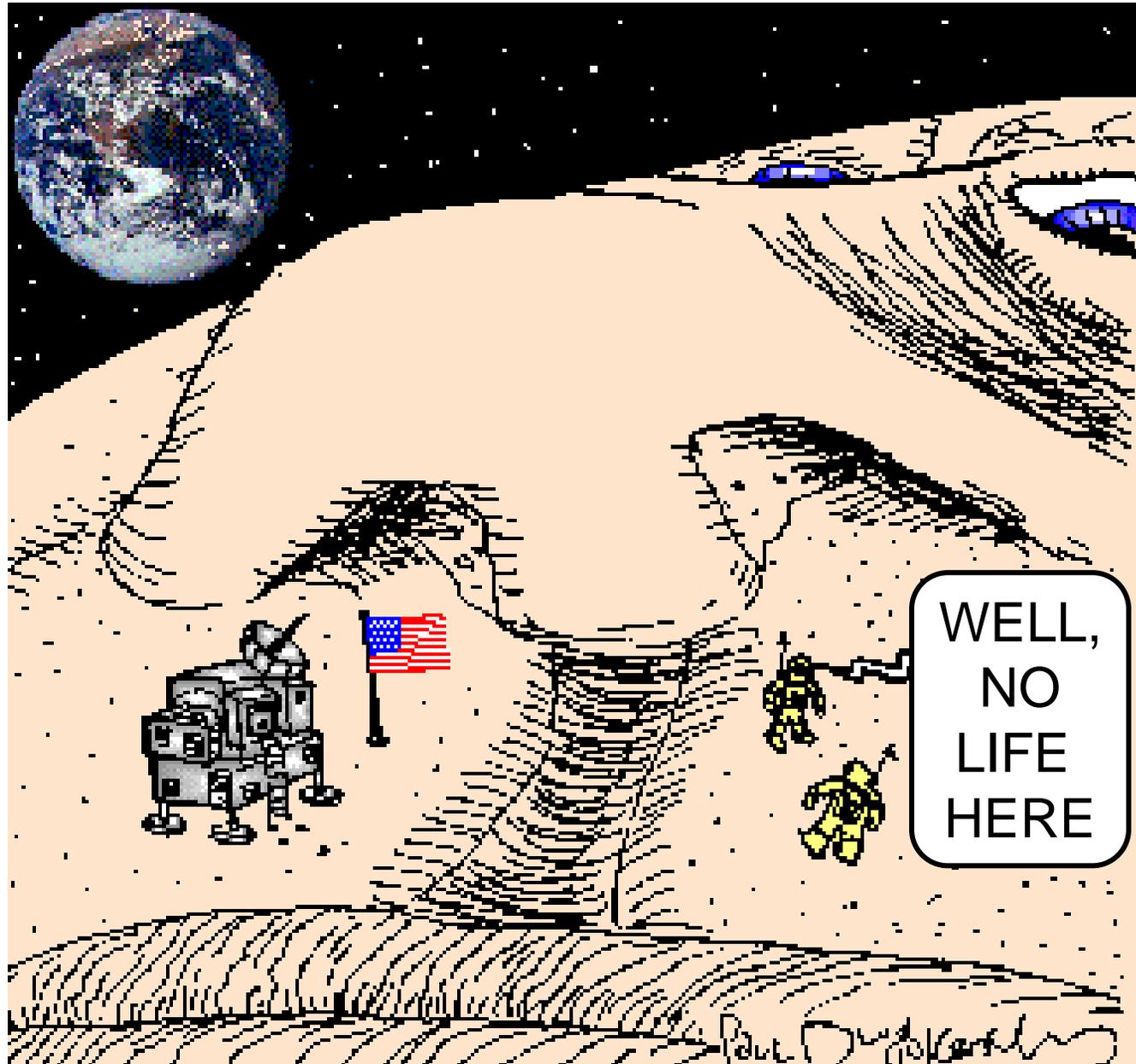
Are models designed to PREDICT or RECORD change?

Are all objectives possible with one model?

Can we standardize model development?

- Threshold based
 - Tautology of states and thresholds
 - Should there be unified definition?
- Process criteria
 - The 'action verbs' of an ecosystem: consume, decompose, exchange, produce, transfer, recycle, reproduce, and succeed; they unite biological communities www.nps.gov/grsa/resources/curriculum/glossary.htm
 - How much of a change justifies a new state?
- What are indicators of change?
 - Abiotic vs. biotic; wildlife?
- What is the spatio-temporal scale of a S&T model?

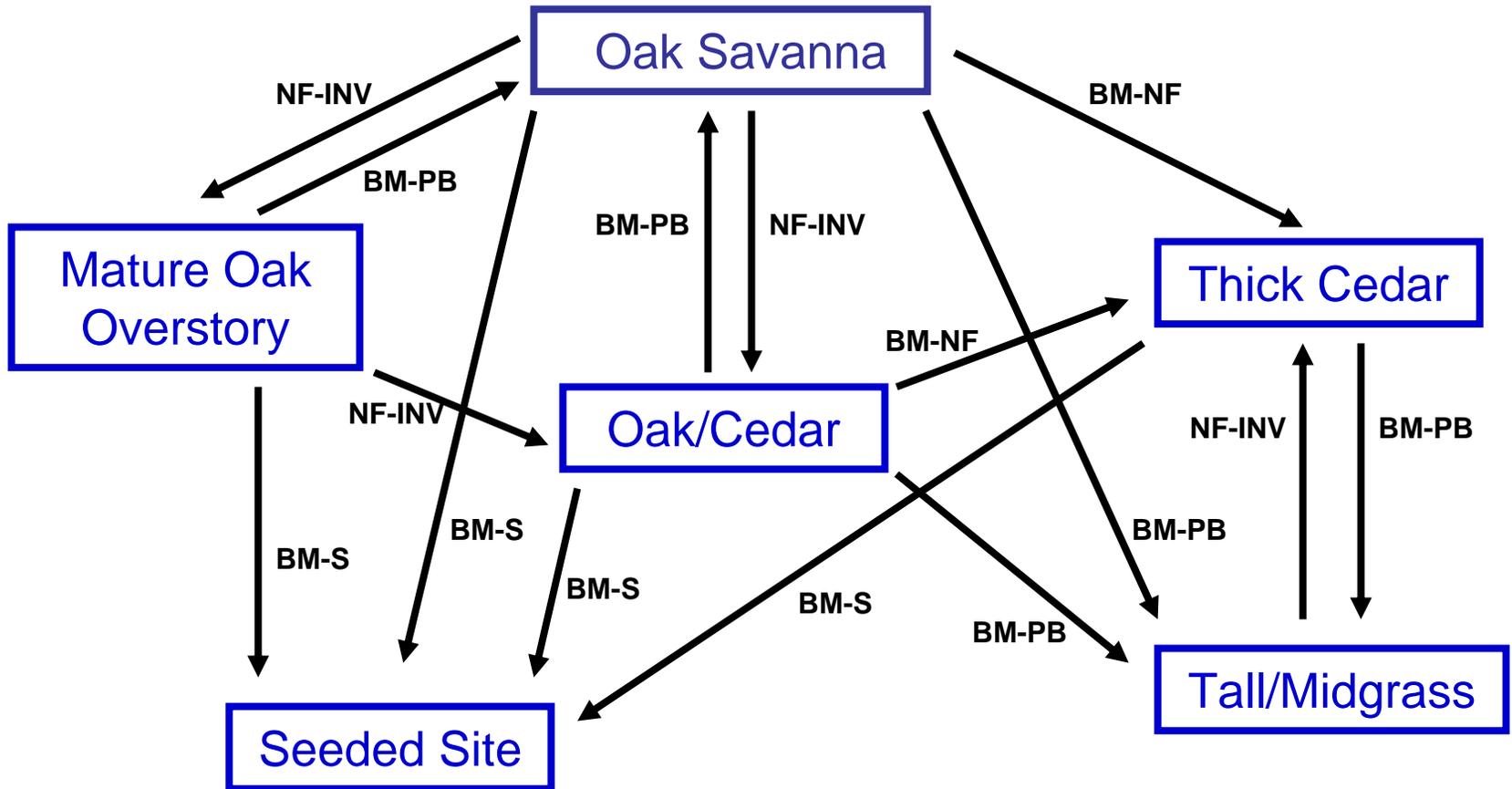
Who needs to worry about scale?



Do we want science (ecology) to be involved in S&T models?

- If no, then status quo (avoids criticism)
- If yes, then science should be considered during model development
 - Science-based management
 - Models can generate testable hypotheses
 - “Testable” requires numbers
 - Science can lead to refinement of models
 - Must engage scientists outside of range
 - Can we test our current S&T models?

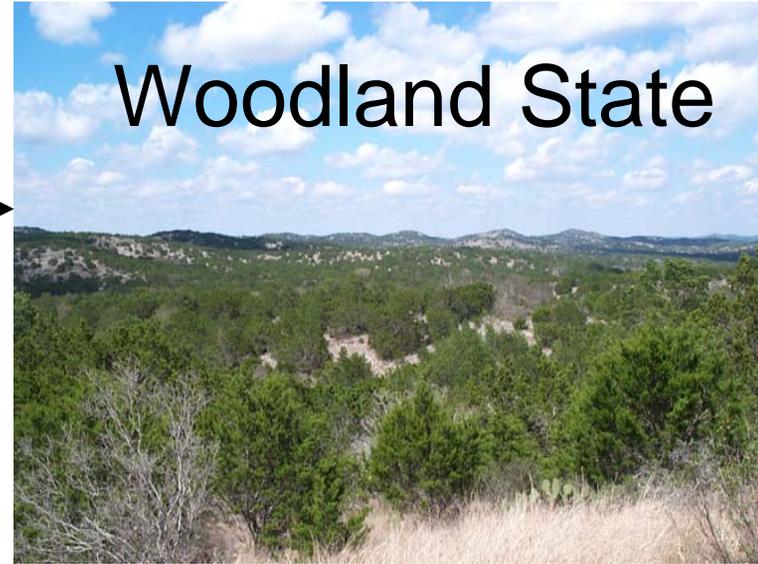
Shallow Savanna Cross Timbers, Oklahoma



Grassland State



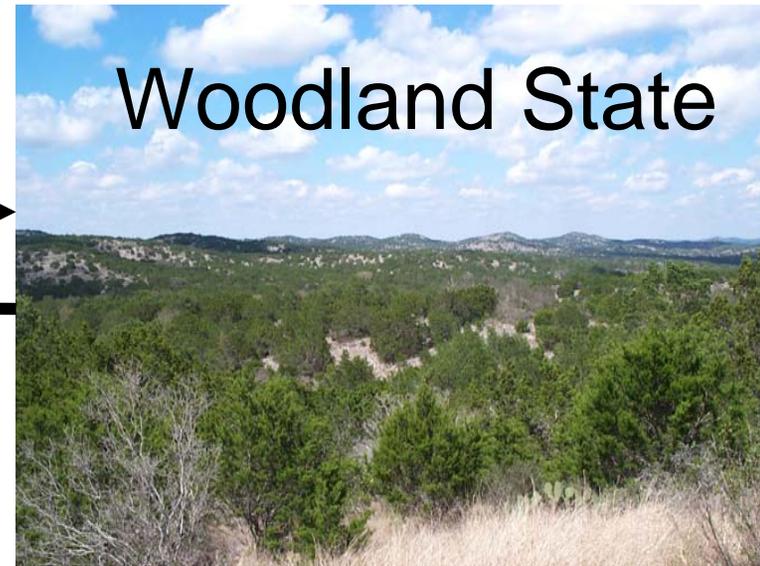
Woodland State



- Will a grassland transition to a woodland?
- How long will it take?
- Are there predictable indicators?
- What are the drivers?



Grassland State



Woodland State



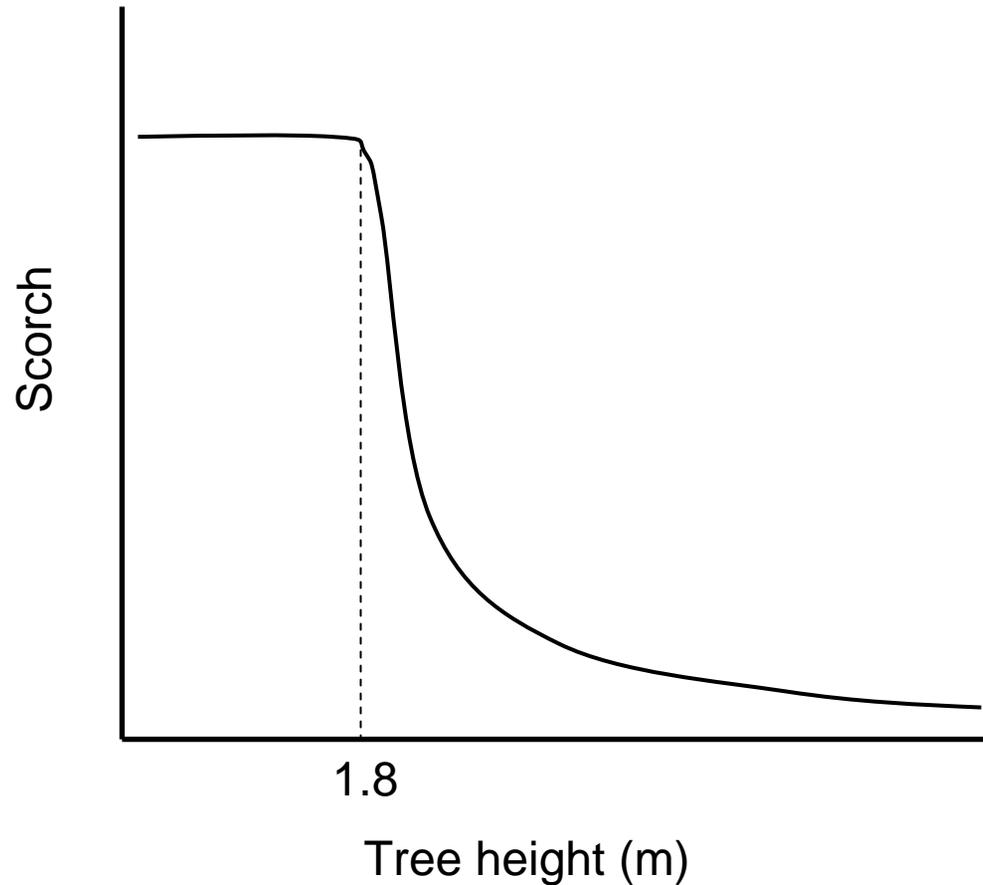
?

- Are the changes reversible?
- At what point do they become irreversible?
- Time?
 - If fire is removed for 150 years then how long should it be restored before we recognize a threshold?

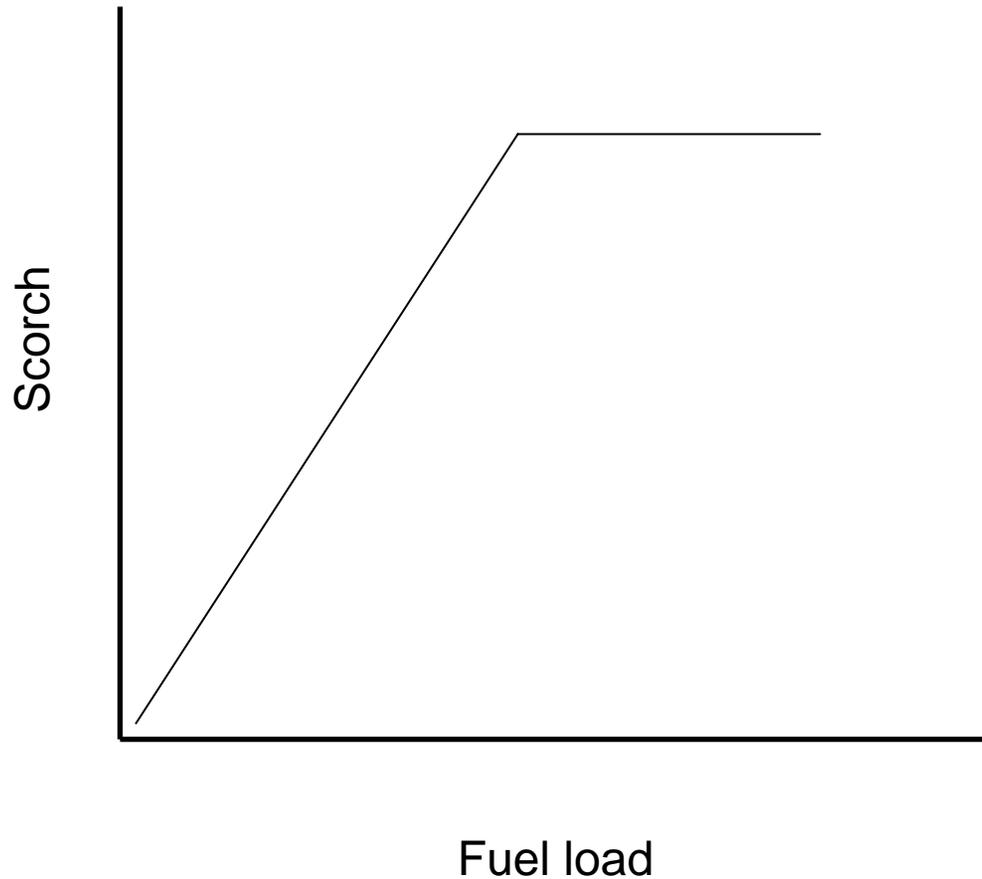
Ways science can test/contribute to S&T models

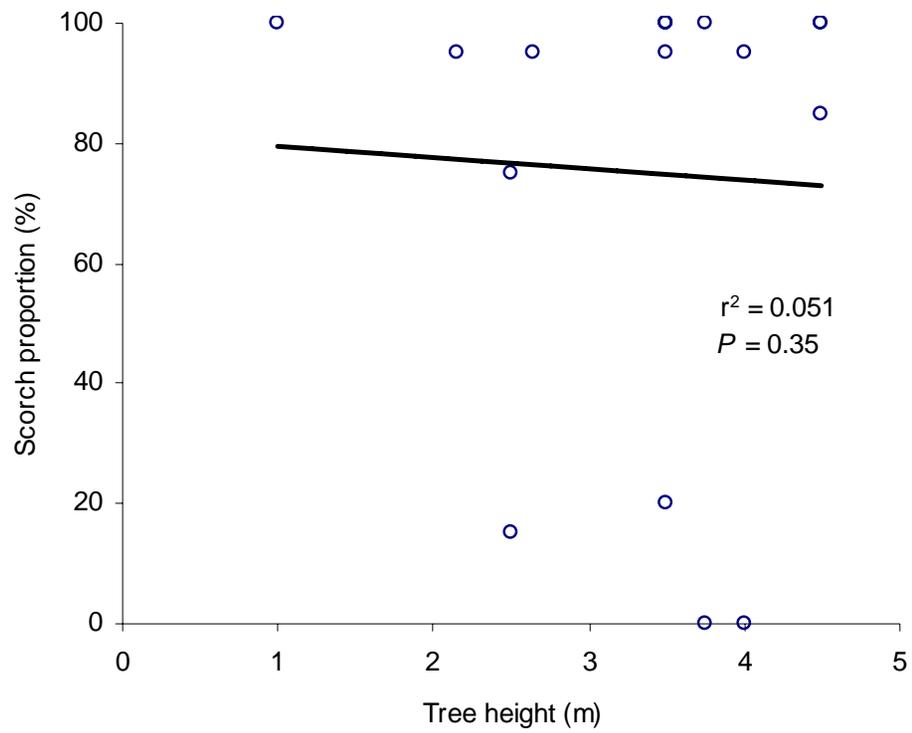
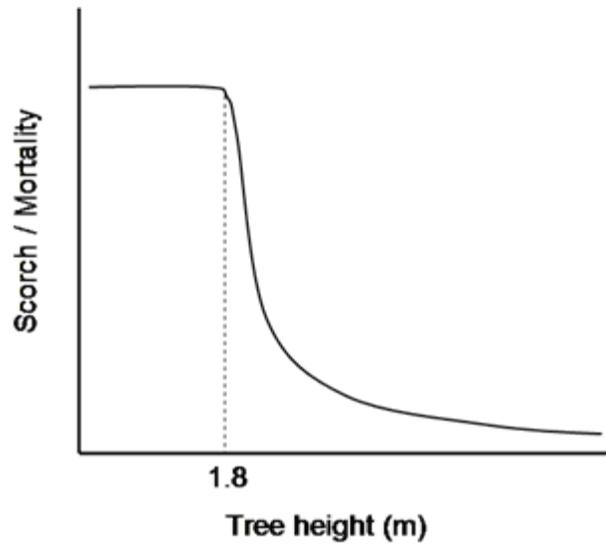
- Remote sensing
- Simulation modeling
- Long-term experiments
- Test mechanisms associated with states, transitions, and thresholds

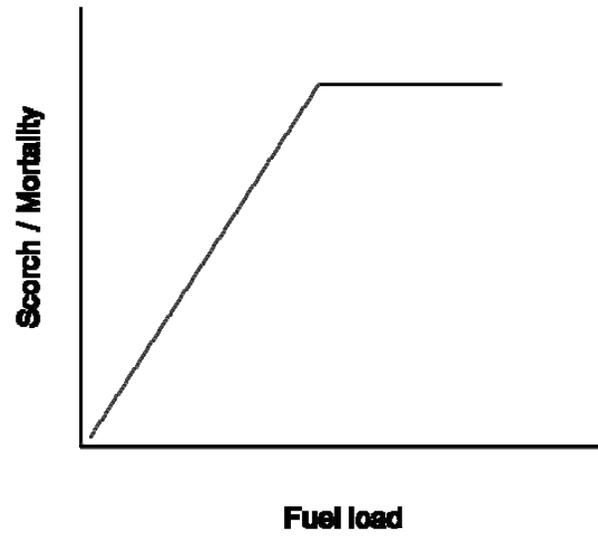
Mechanisms associated with grassland to woodland model

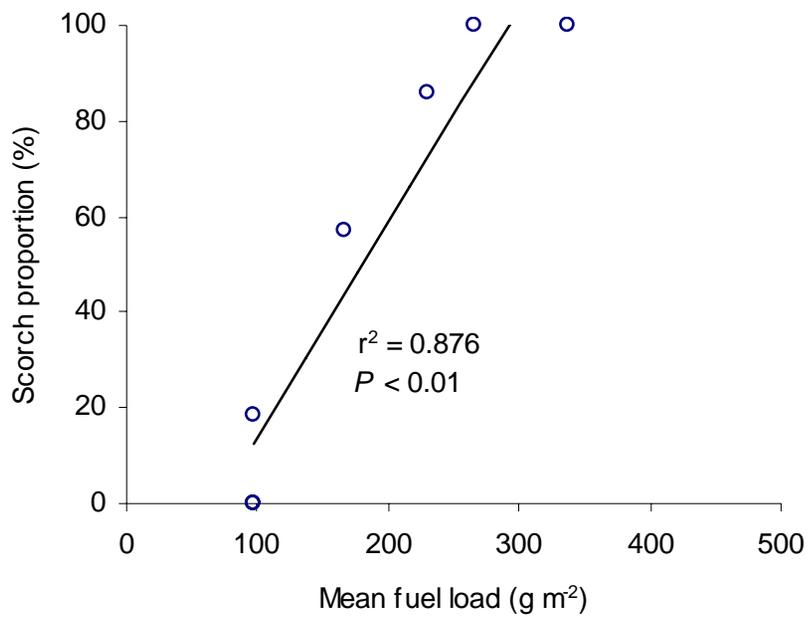
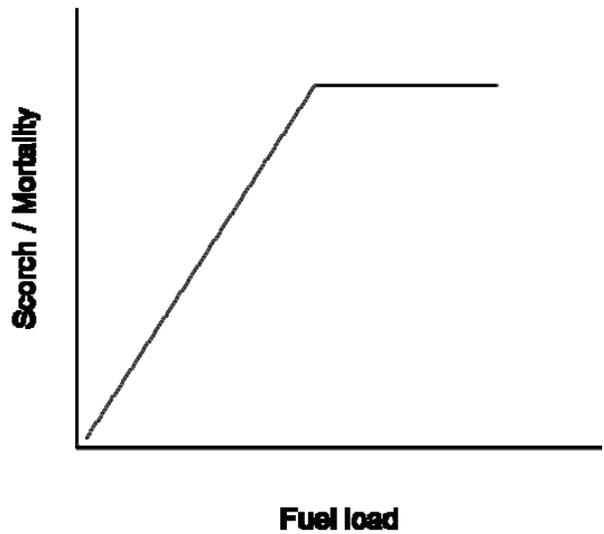


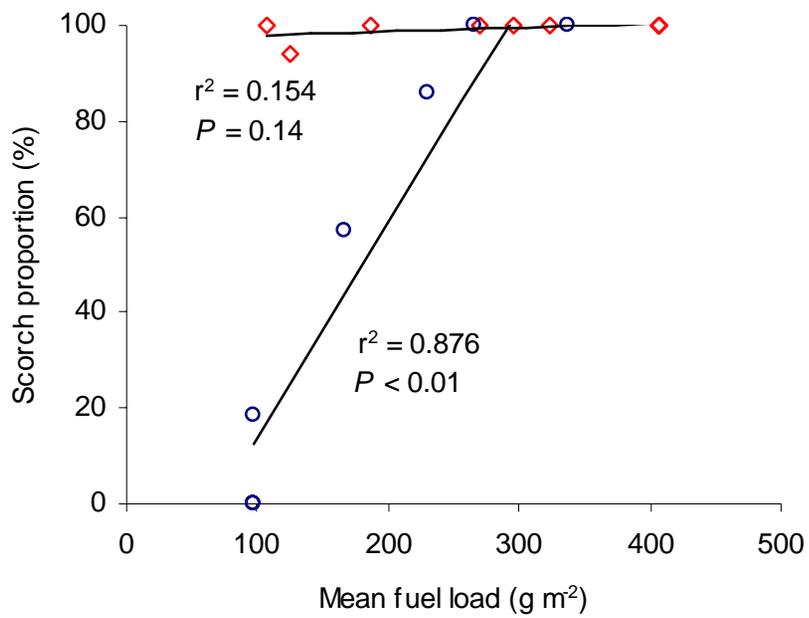
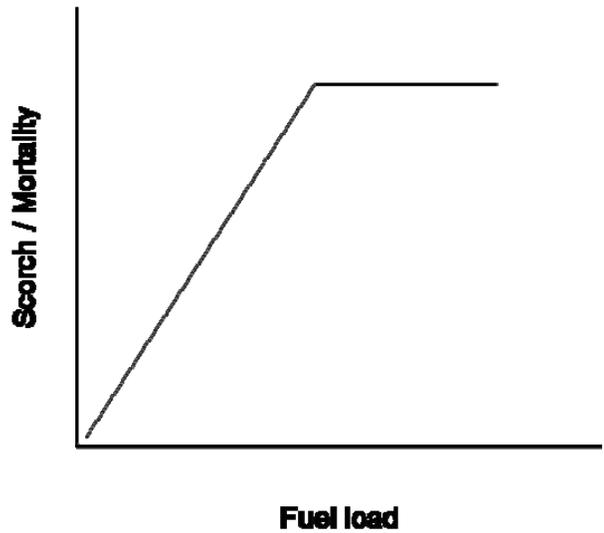
Mechanisms associated with grassland to woodland model













How do we integrate emerging ecological concepts and alternative objectives?

- Emerging Ecological Concepts
 - Heterogeneity
 - Climate change
 - Invasive species
 - Fragmentation
- Alternative Objectives
 - Wildlife management
 - Ecotourism
 - Threatened and Endangered species
 - Biodiversity
 - Wind energy

Importance of Heterogeneity

- **Hydrology** –Belnap et al 2005, Ludwig et al. 2000, Eldridge et al 2002
- **Fire behavior** –Fuhlendorf and Engle 2001 - Archibald et al. 2005- Kerby, Fuhlendorf and Engle 2007
- **Grazing patterns** –Senft et al 1987, Stuth 1991, Fuhlendorf and Engle 2004, Fryxell et al. 2005.
- **Soil aggregate stability and nutrient cycling** – Bird, Herrick et al. 2002, Augustine 2002, Anderson et al (in review)
- **Ecosystem stability** –Brown 2003, Holling and Meffe 1996, van de Koppel and Rietkerk 2004
- **Species invasion** –Deutschewitz et al. 2003, Cummings, Fuhlendorf, Hickman and Engle (In review)
- **Root of biological diversity** –Christensen 1997, Wiens 1997, Fuhlendorf and Engle 2001, Fuhlendorf et al. 2007
- **Etc.**

Summary of Issues and Concerns

- What is/are the objective(s) and who is the target?
 - PREDICT or RECORD change
- Can we standardize model development?
- Do we want science to be involved in S&T models?
- What is needed to make S&T models predictive and testable (science based)?
- How do we integrate emerging ecological concepts and alternative objectives?

Issues and Concerns— from Joel Brown in Utah in 2000

<http://www.glti.nrcs.usda.gov/technical/presentations/st-tran-workshop/questions.html>

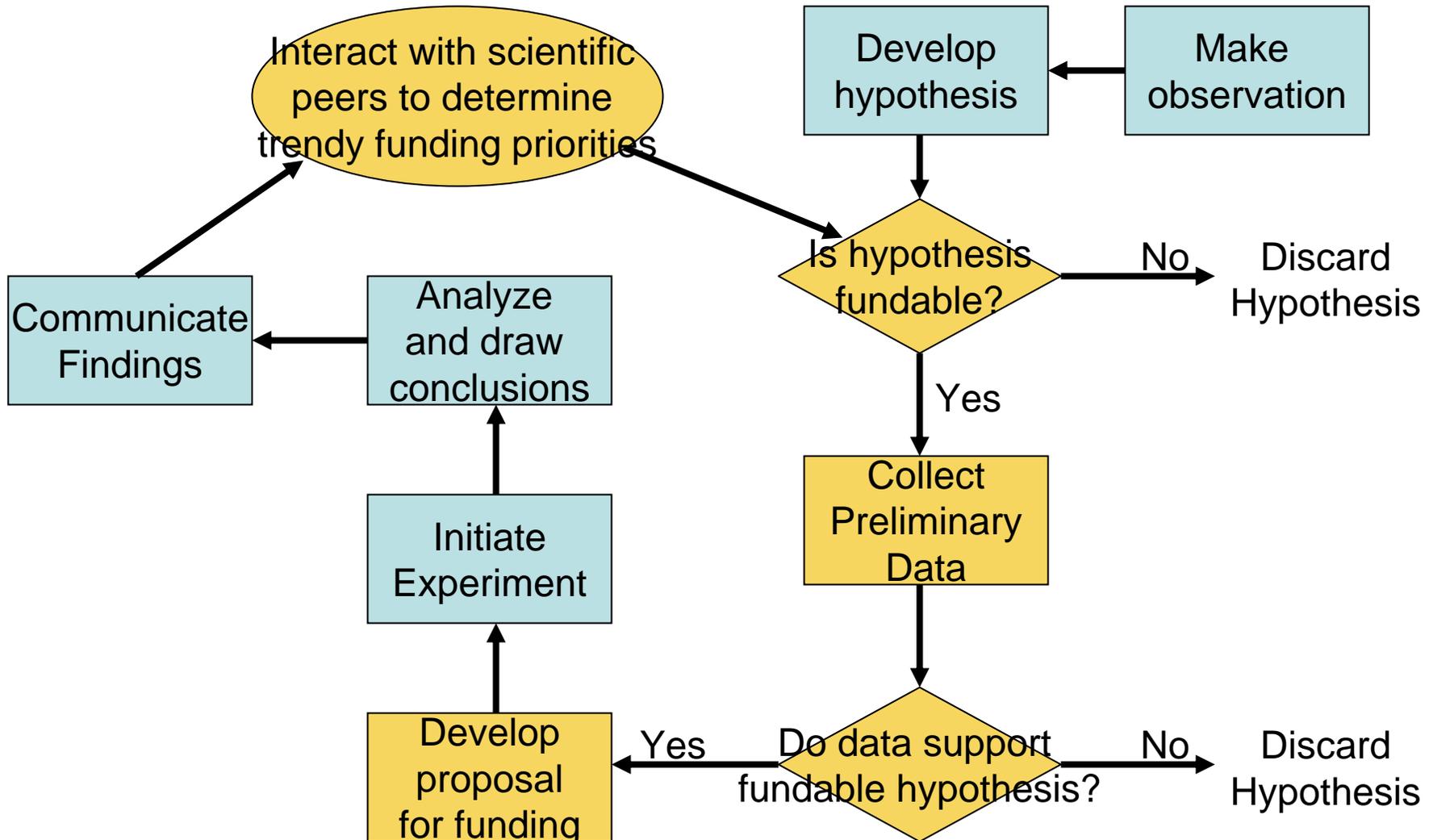
- What is a state?
- What is a transition?
- What are thresholds?
- What about soil loss?
- Should Riparian areas be separate sites—1st point
- What are time frames and how do we express them?
- Is there a way to integrate wildlife into STMs?

Biggest Issue: Why no advancement?

- S&Ts are based on thresholds which are mostly untested
- Models have not been developed in a testable manner
- S&Ts not considered high priority within the broader scientific community
- No Science = No Advancement
- No Funding = No Science

New Scientific Method

Herding cats in the 21st century



Box and arrows wont get rid of
cedar, but a box matches will

John Weir 2006

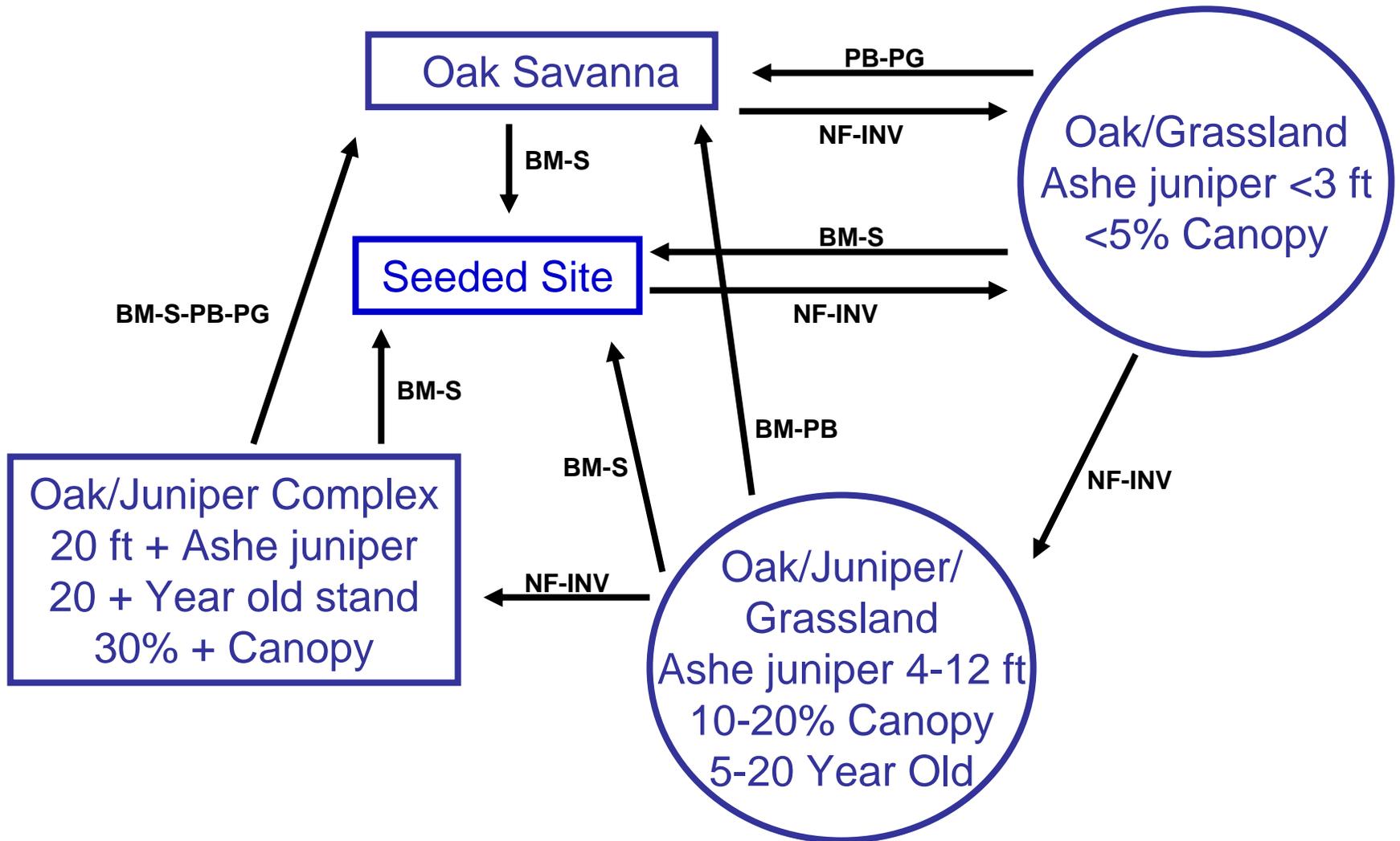
What is the role of science in S&T models and ESDs?

- If there is to be scientific involvement in the development and justification of S&T models then they need to be testable, i.e. quantifiable.
- Scientifically testable models are essential for science-based management
 - Do we want science based management?
- If we keep referring this to an ecological theory then it needs to be evaluated with ecological sciences.
- What is needed to make them quantifiable or testable?

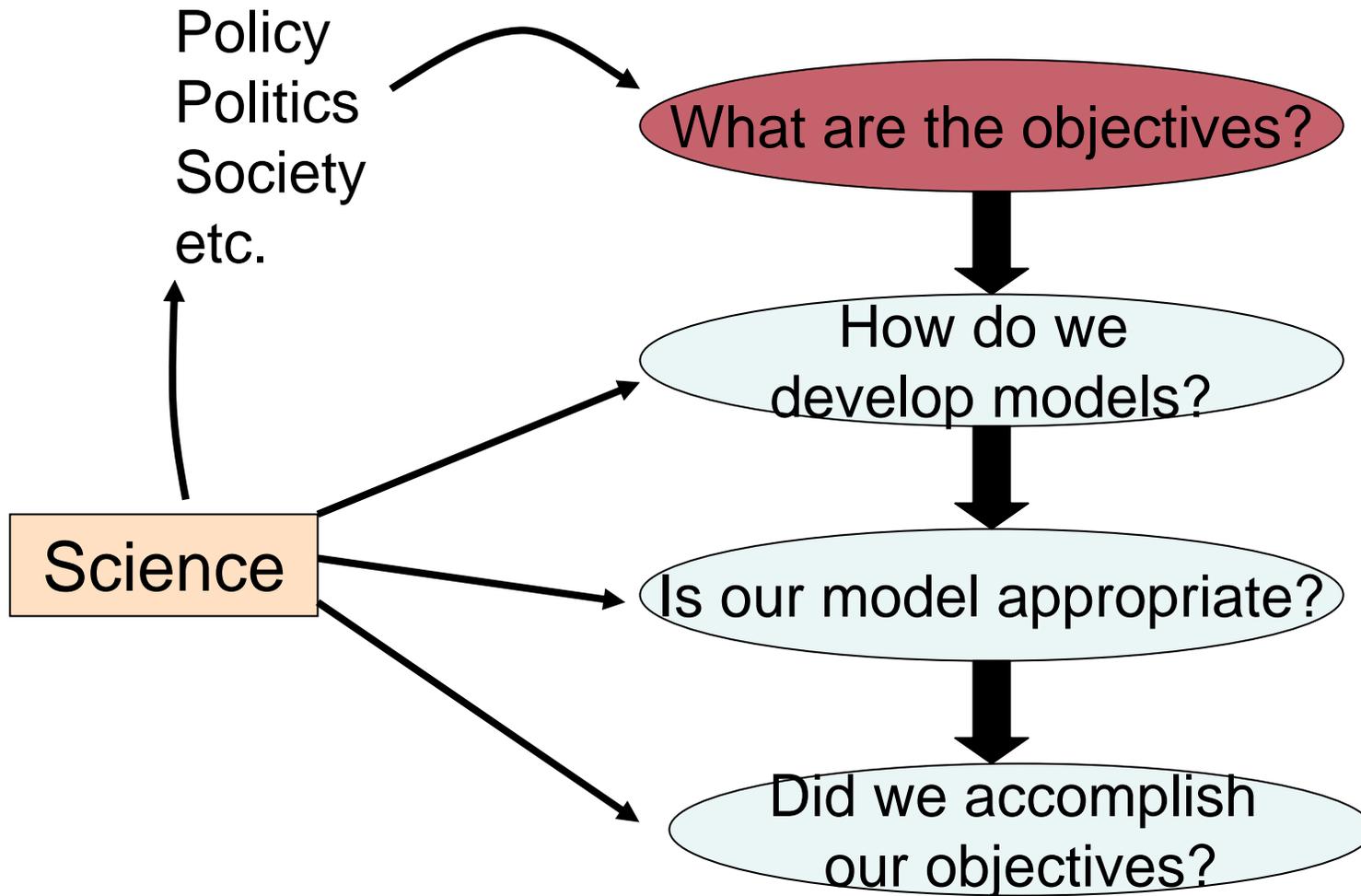
Is S&T a scientific (ecological) theory?

- An explanation of why and how a specific natural phenomenon occurs. Examples of theories: Newton's Theory of Gravitation, Darwin's Theory of Evolution, Mendel's theory of Inheritance, Einstein's Theory of Relativity. www.ncsu.edu/labwrite/res/res-glossary.html
- A hypothesis that is widely accepted by the scientific community. www.ametsoc.org/amsedu/WES/glossary.html
- a statement that postulates ordered relationships among natural phenomena. farahsouth.cgu.edu/dictionary/
- A body of knowledge using controlled-variable experimental methods to construct a formal and mathematically structured system. It studies the character of natural reality. www.udmercy.edu/faculty_pages/staudenmaier_sj/ethics/glossary

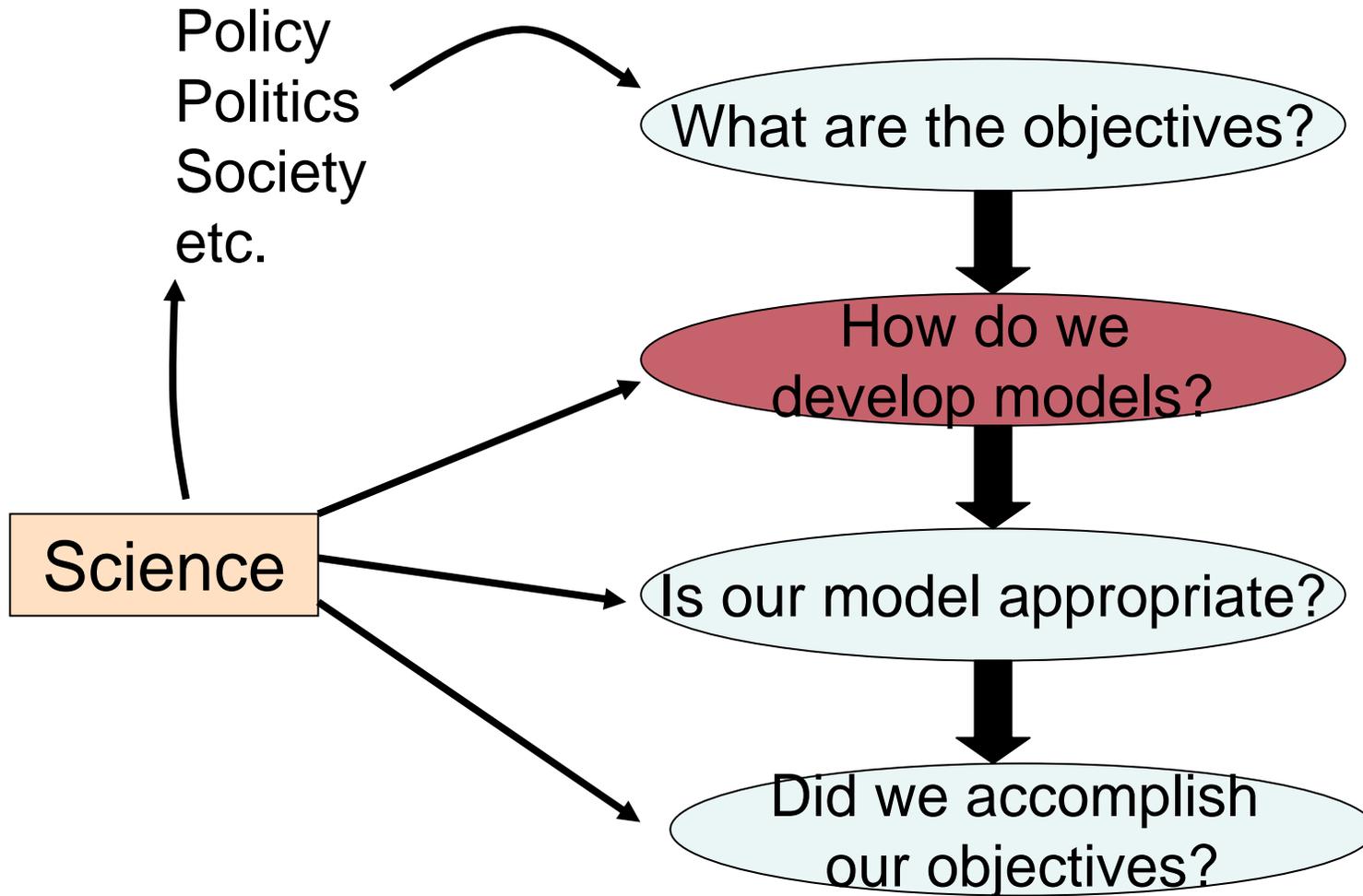
Redland Ecological Site - Draft Edwards Plateau, Texas



Evaluating S&T models and ESDs



Evaluating S&T models and ESDs



Evaluating S&T models and ESDs

