

Incorporating the Long Term Perspective into Resilience/Sustainability Science

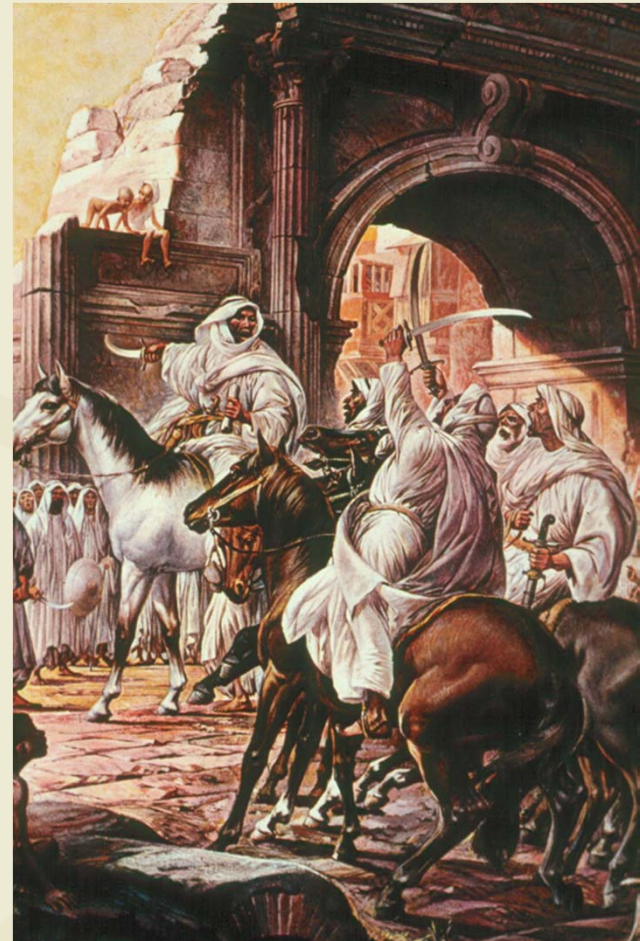
LTER Science Council
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Why is the Long Term Research Essential to Resilience/Sustainability Science?

- Some processes take a long time to be manifest
- Observe full cycles, multiple cycles
- Observe outcomes of pulses and presses under many conditions
- Trace actual trajectories, not projections, reconstructions



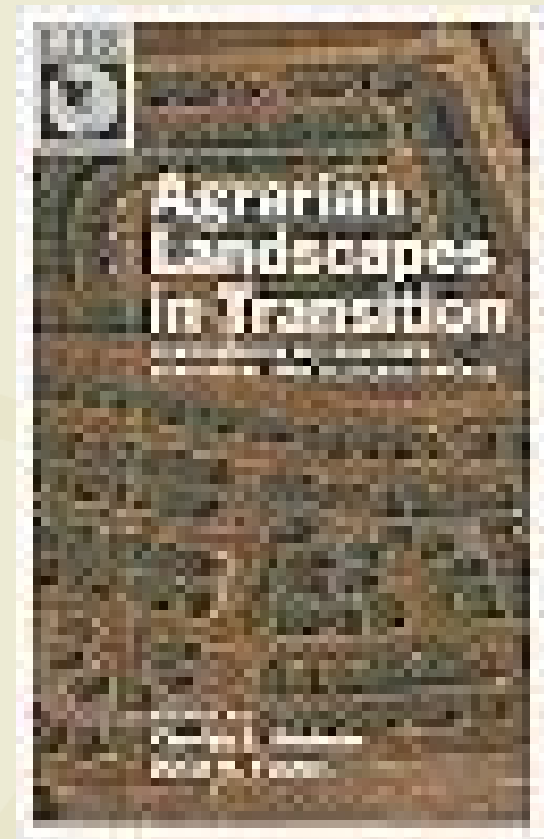
Concepts to organize our thinking



- Mental models
- Triggering events
- Regime shifts
- Decision points
- Intervention points
- Projections of the future
- Scenarios of the future

How LTERs Can Contribute

- Rich, long term data base
- Observation of human/nature interactions, feedback and outcomes
- Can identify warnings, triggers, interventions
- Reposition our thinking to a point in the past looking forward



What is Sustainability?

What is Resilience?

Definitions

Resilience: The ability to maintain functions in face of change

Sustainability: The ability to continue without interruption

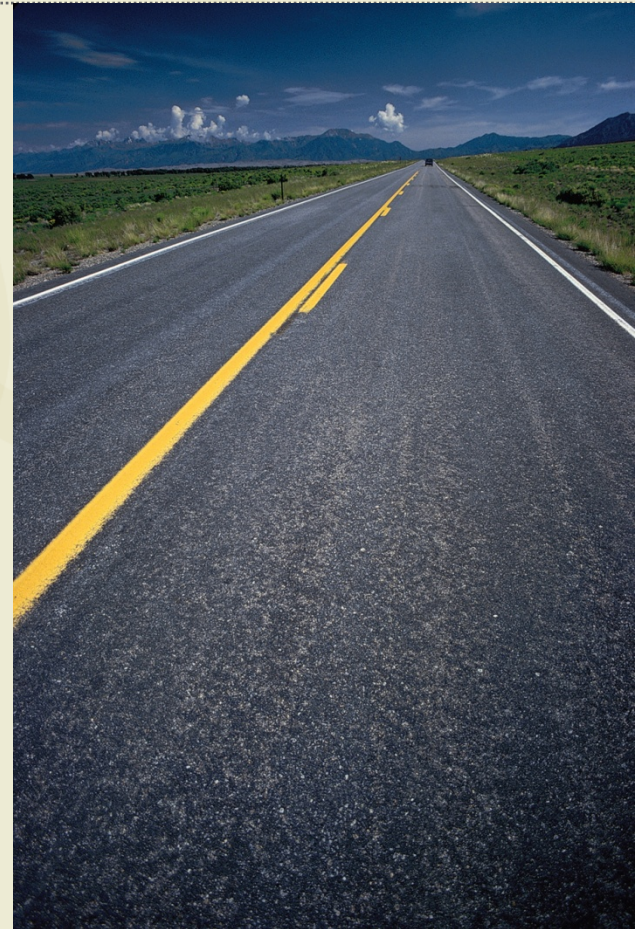
But one must ask:

Of what?

For whom?

For how long?

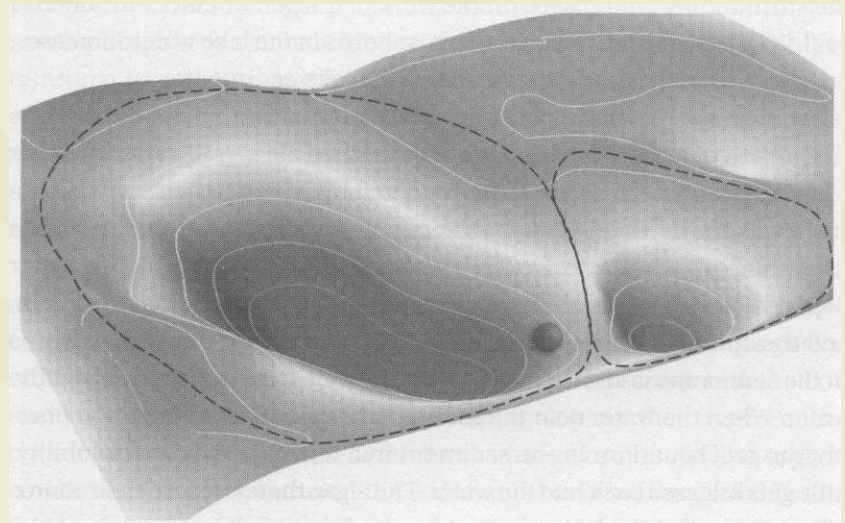
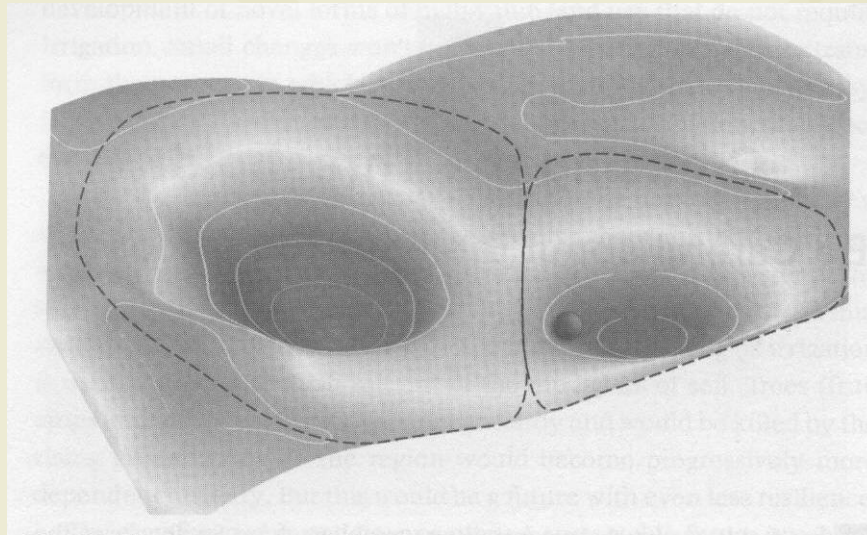
At what cost?



Resilience Theory

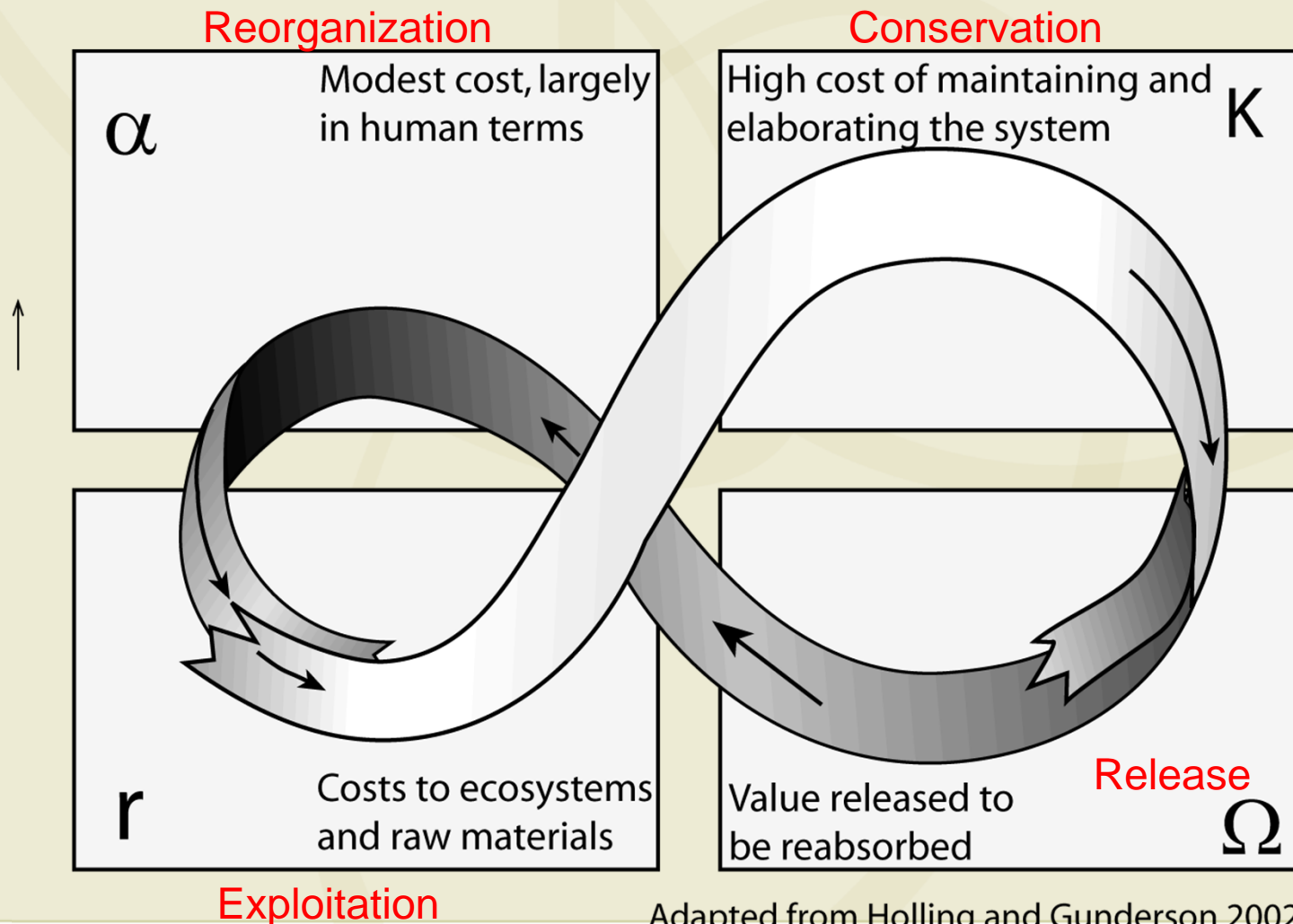
- Emerged out of ecology from frustration with succession theory and life cycle analogy
- Fast and slow variables, thresholds, and regime shifts
- In K-phase major investment in maintaining order
- Collapse (release) often happens when system is at its “height”
- When it collapses one cannot predict pathway
- Emphasis on cross-scale interactions in the PANARCHY

Ball in “Basin of Attraction” Model of a Resilience Landscape



Through actions one can change the shape of the landscape, such as the height of thresholds between two basins, or the position of the ball (i.e., city) within the basin

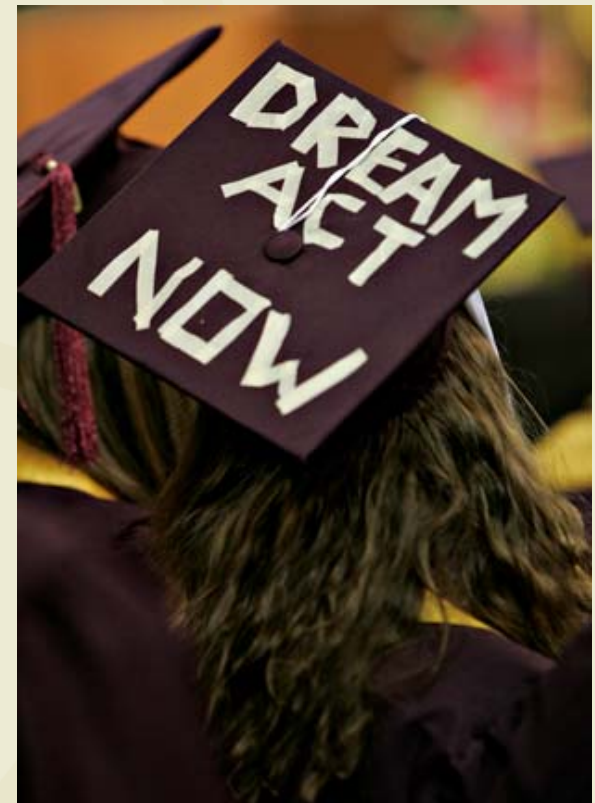
The Adaptive Cycle: Holling's Figure Eight



Adapted from Holling and Gunderson 2002

What is Sustainability about?

- Awareness of connections
- Creativity to find solutions
- Stewardship of resources
- Institutions that continually learn (anticipatory governance)
- Instilling a sense of justice (values)



Should we separate Resilience and Sustainability for their own good?

Each of us want our “science” to encompass all approaches?

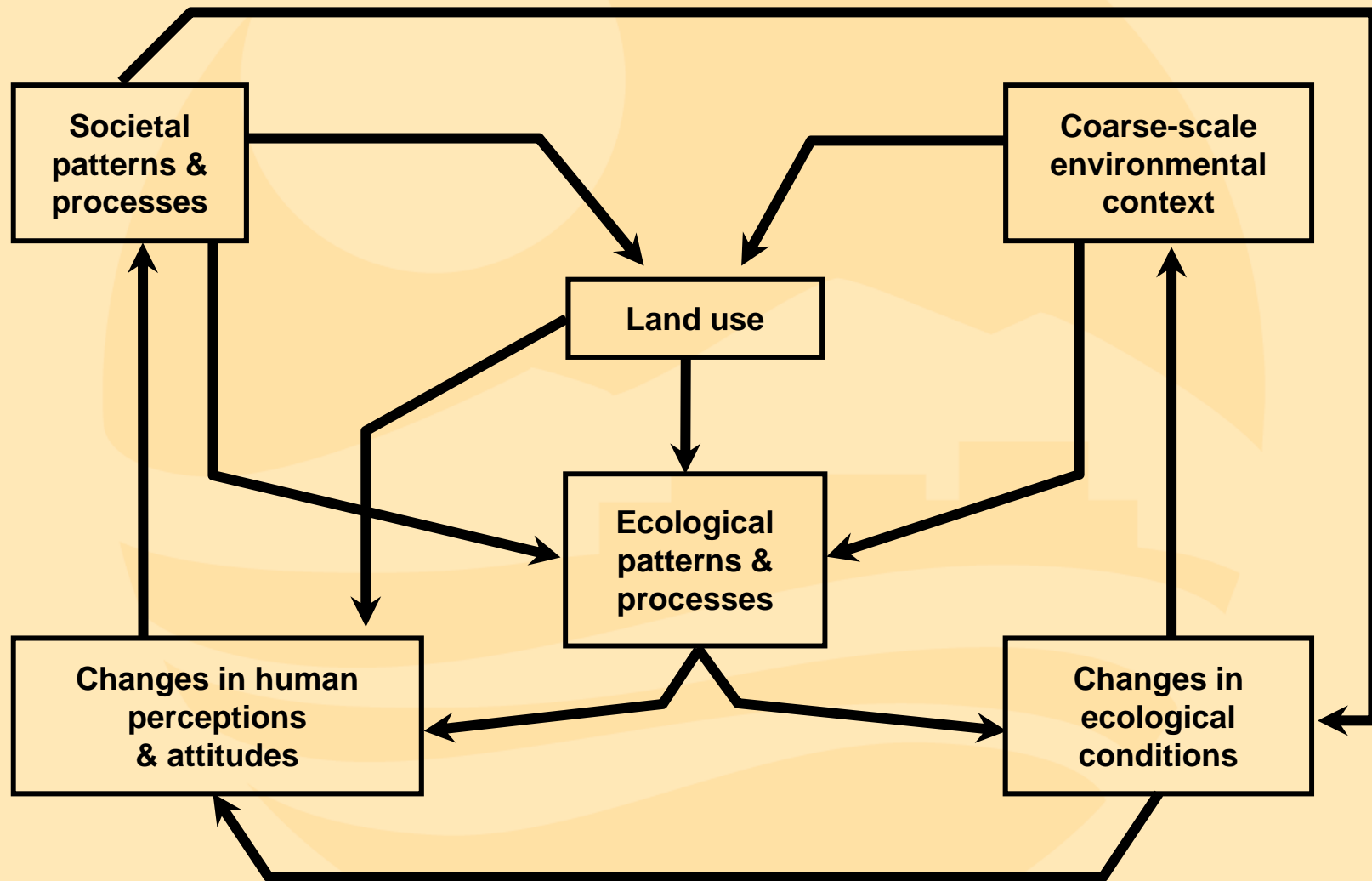
I propose

- Resilience is about the now and the near now
- Sustainability is about future conditions

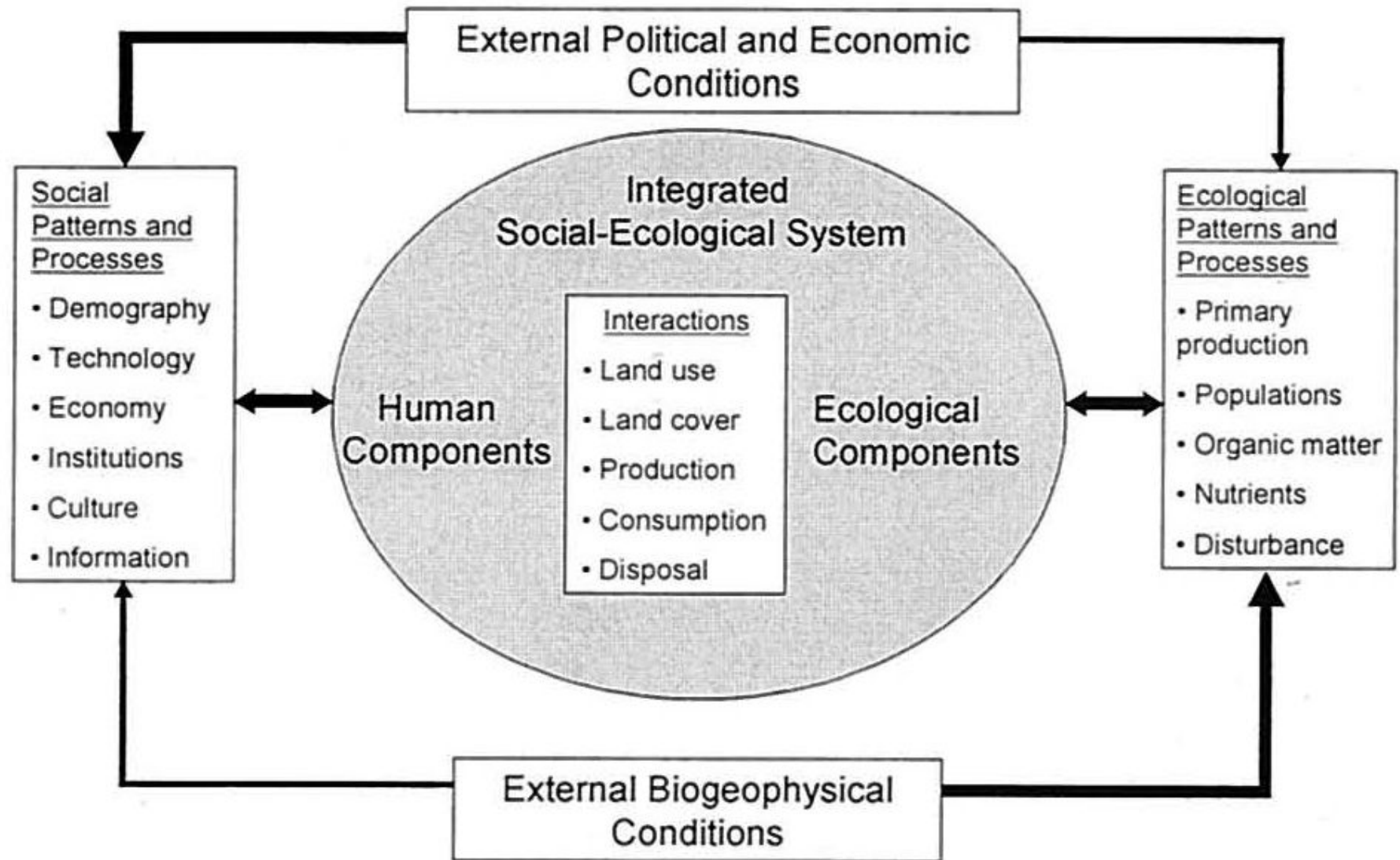
Resilience emphasizes qualities of the system, it may influence, but does not predict the outcome of the adaptive cycle

Sustainability seeks to transition system to “improved” conditions; normative, futures focused

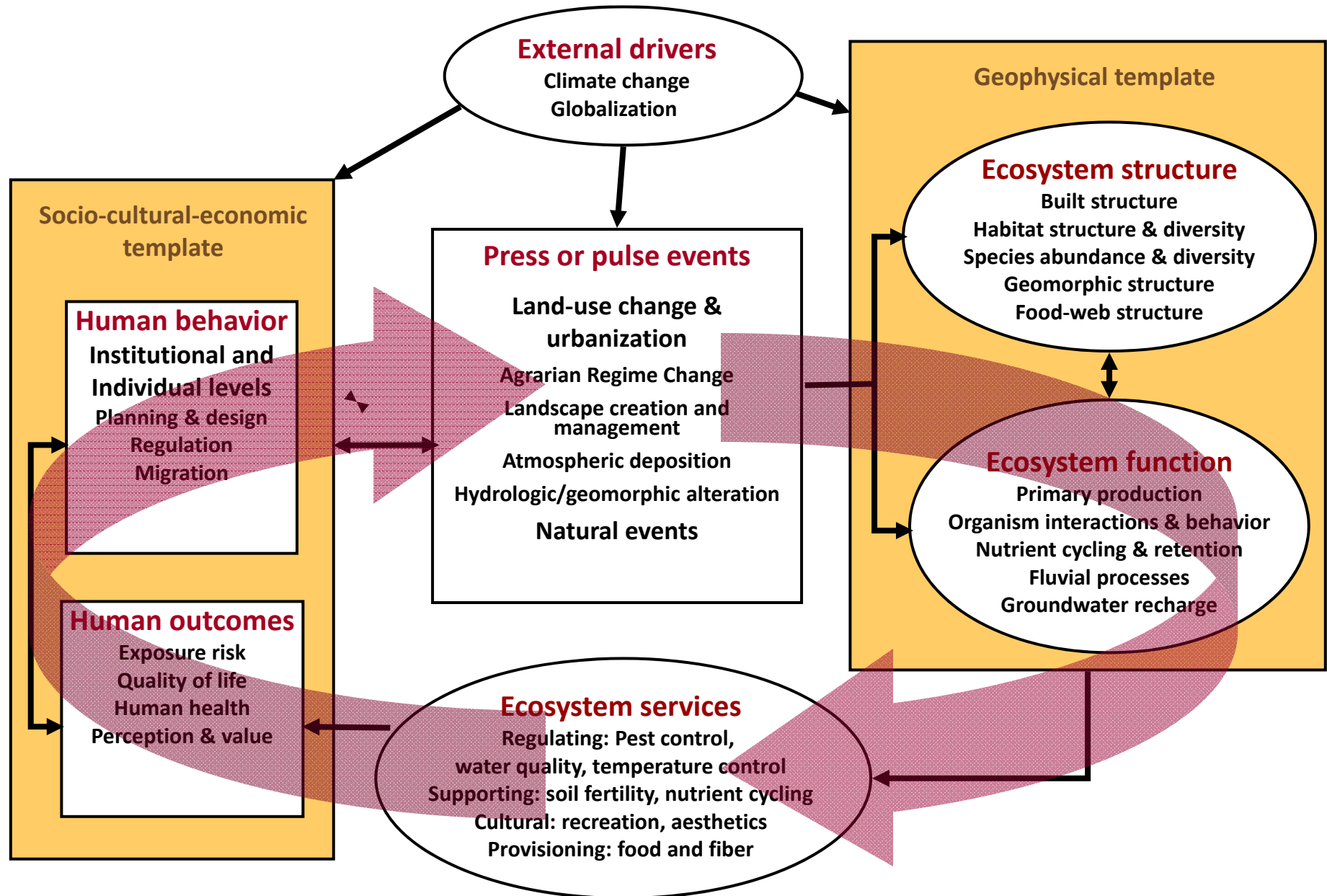
Conceptual Framework for CAP LTER 1 - 1997



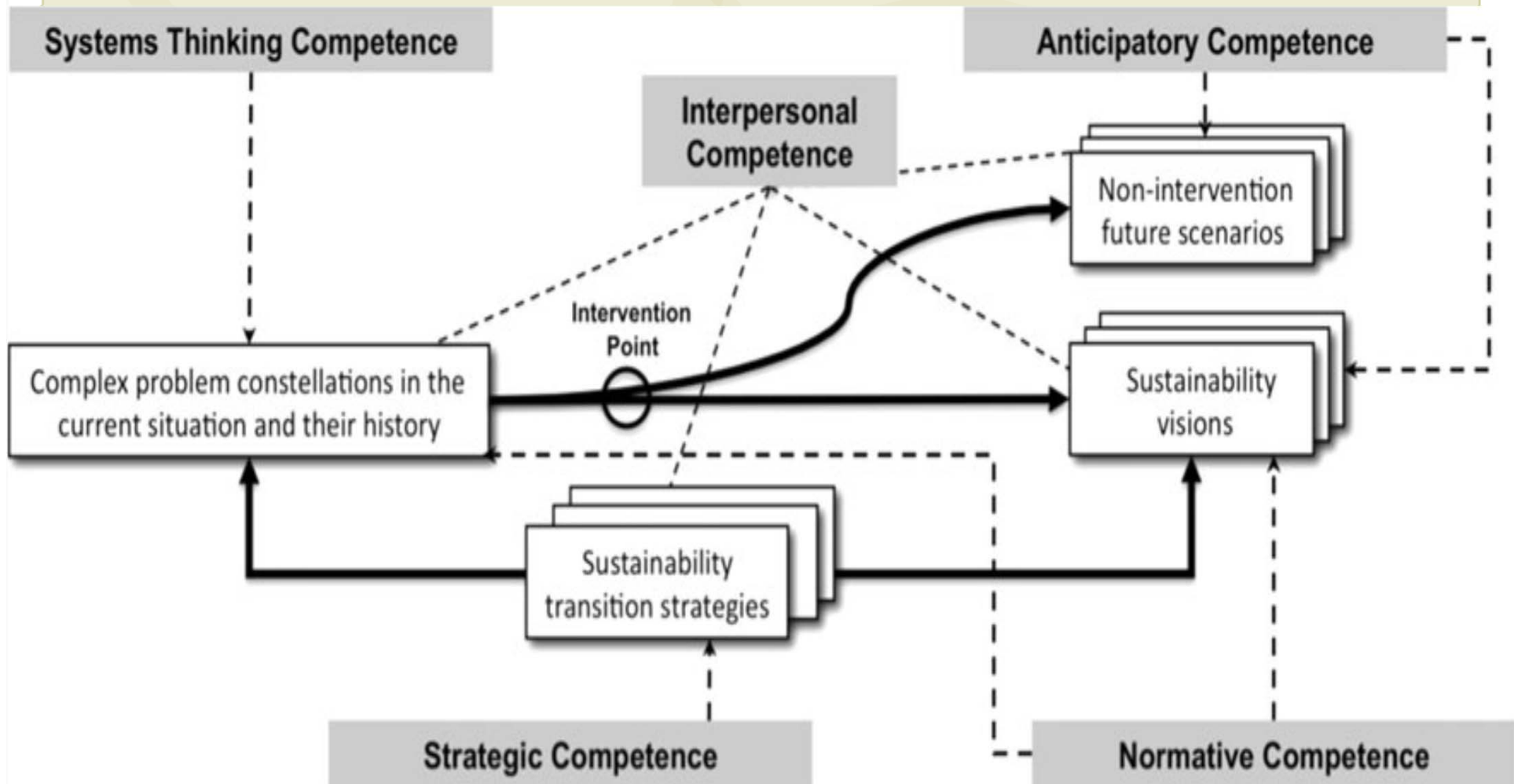
LTER approach from 2000 workshop



Conceptual Framework after Collins et al. 2007 ISSE



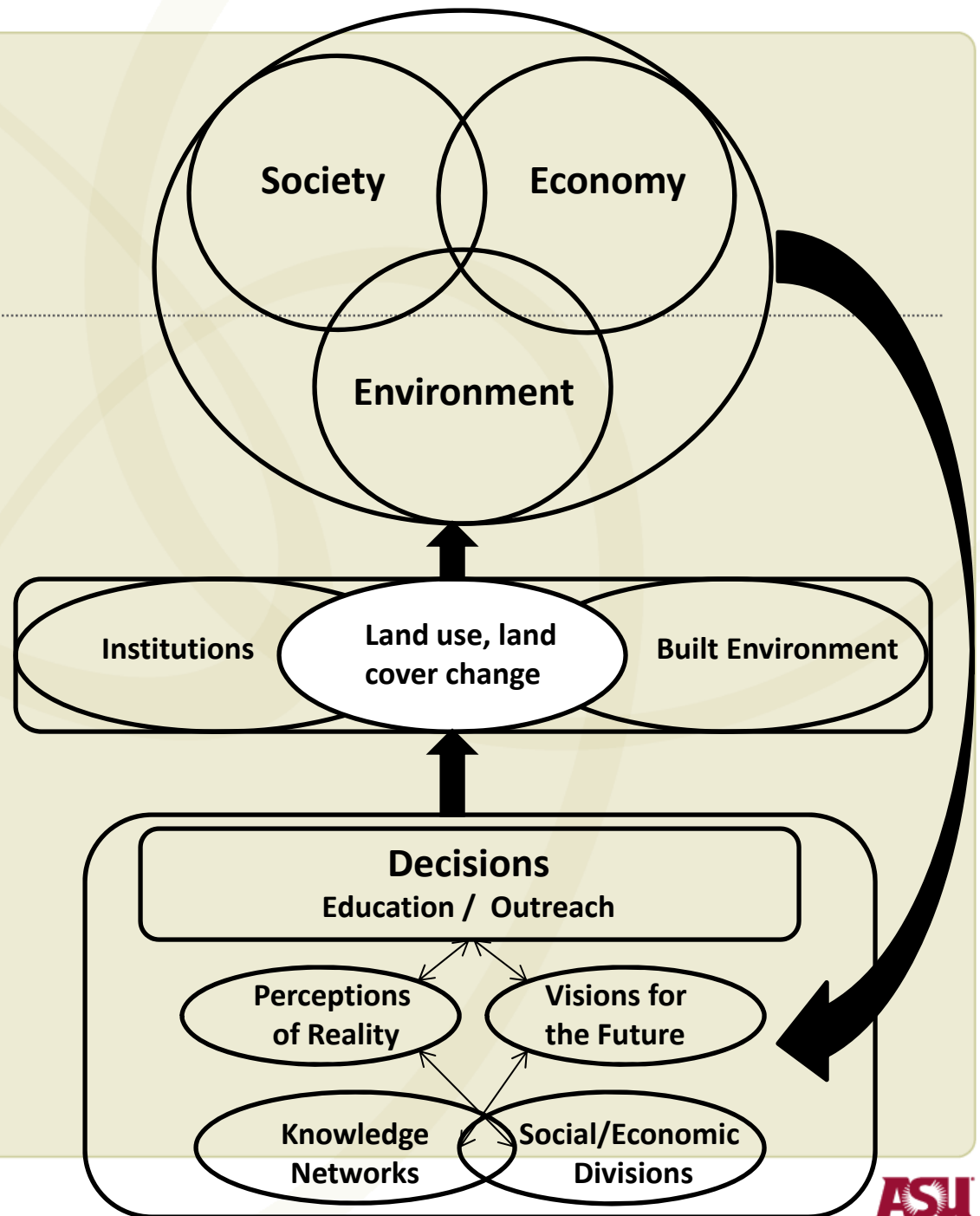
Framework for Sustainability Research/Solutions 2011



Outcomes
System State with
Connectivity

Mechanisms for
Implementing Decisions

Knowledge and Values
That Underlie Decisions



How can LTERs anticipate future sustainability research?

Trade-offs: What trade-offs are inherent in coupled social-ecological systems? What are the tools available to recognize and navigate those trade-offs?

Understanding uncertainty: Which uncertainties in complex adaptive systems are reducible and which are irreducible? Will these uncertainties grow or diminish over time?

Understanding innovation: How does innovation occur and spread? What technical, economic, and social conditions must be met for technologies to succeed?

A Nobel Prize if you can solve these!

How do we convert avoided future costs into current revenue streams?

How do we embed flexibility and redundancy into a fully efficient system?

How can long term sensibilities and values be integrated into short term management and decision making?

