

# Greybull River Sustainable Landscape Ecology (GRSLE) 2004: Archaeological Panarchy in Northwestern Wyoming



Lawrence Todd (Colorado State University)  
Paul Burnett (Colorado State University)  
Allison Bohn (Colorado State University)



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## 2002-2004 Research along the Greybull River Drainage in NW Wyoming

### Goals:

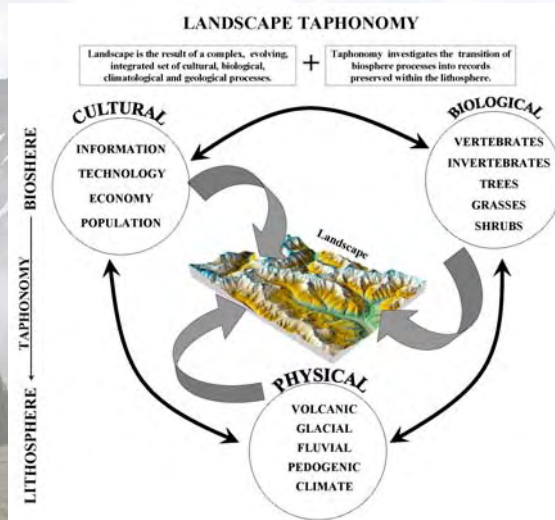
- explore concepts of landscape taphonomy
- provide baseline data for monitoring landscape change
- promote local stewardship
- explore sustainable alternative futures



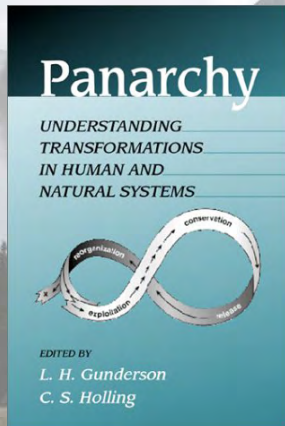
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# LANDSCAPE TAPHONOMY

Transdisciplinary model for research across a range of temporal and spatial scales.....  
...interesting to contemplate, but how to operationalize?



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The first eight slides in this presentation are adapted from the *Resilience Alliance* Resources Library link

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Buzz Holling

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## PANARCHY

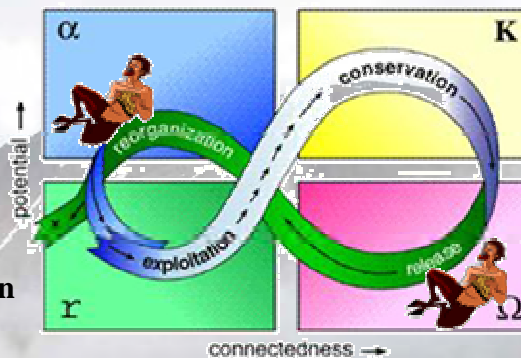
- integrative theory to help us understand the source and role of change in systems
  - importance of the adaptive cycle
  - connections between levels in hierarchies
- “Panarchy is a framework of nature's rules, hinted at by the name of the Greek god of nature- Pan - whose persona also evokes an image of unpredictable change. Since the essential focus of Panarchy is to rationalize the interplay between change and persistence, between the predictable and unpredictable, Holling et al. (2002) draw on the notion of hierarchies of influences between embedded scales, that is pan-archies, to represent structures that sustain experiments, test its results and allow adaptive evolution.”

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## ADAPTIVE CYCLES

Potential (Capital) of accumulated resources:

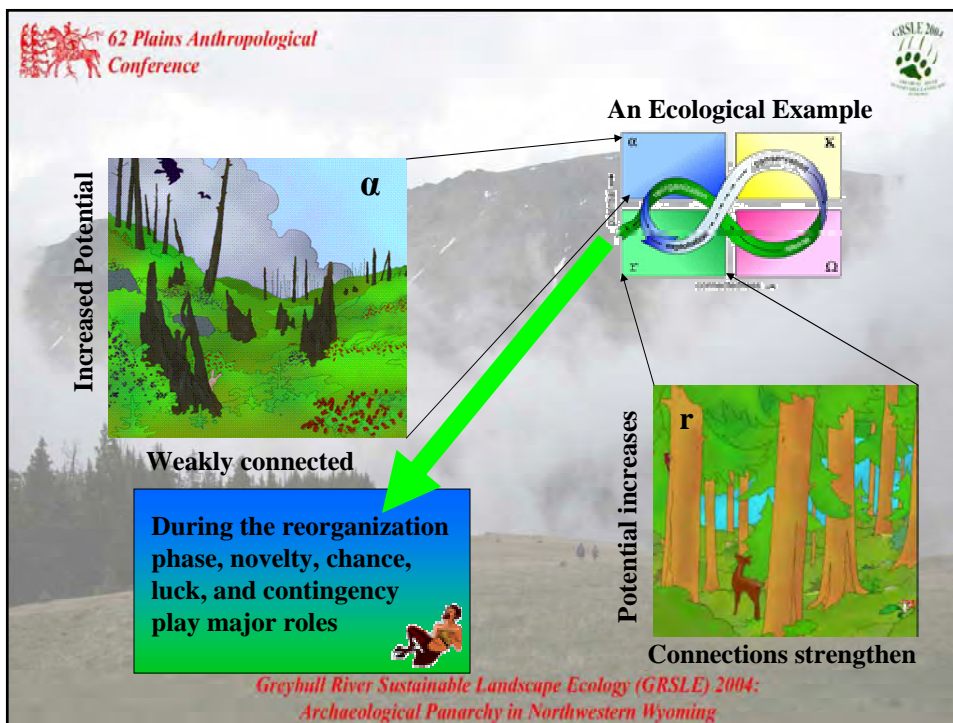
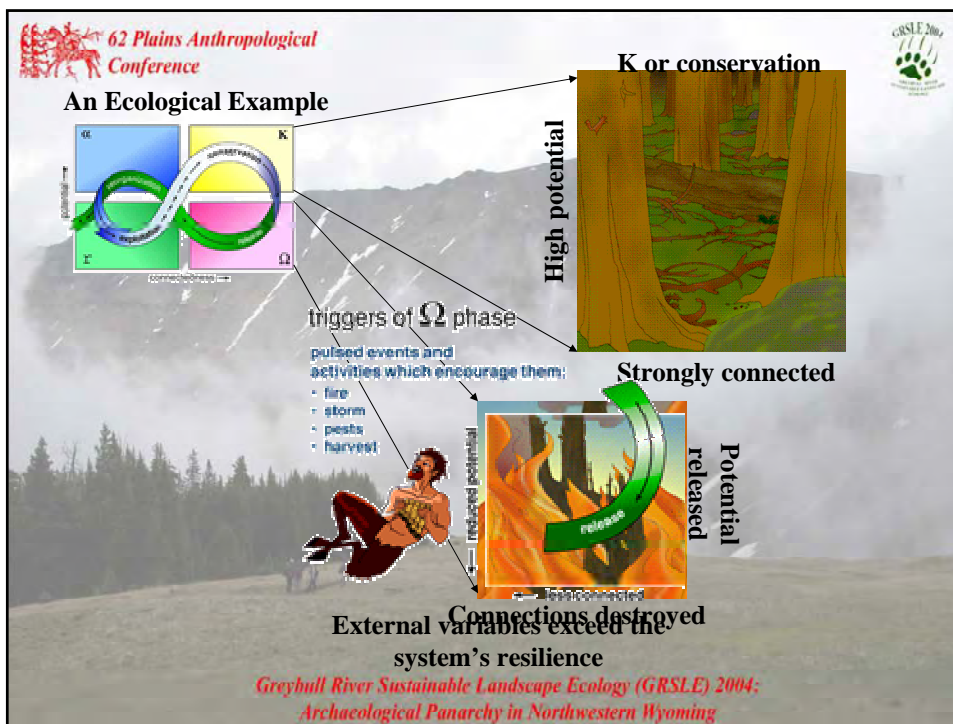
- Biomass
- Nutrients
- Information



Connectedness among controlling elements

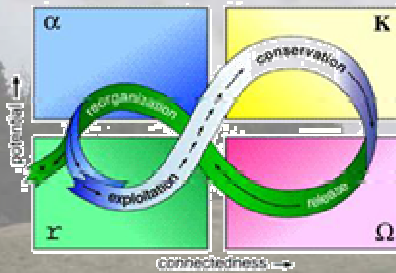
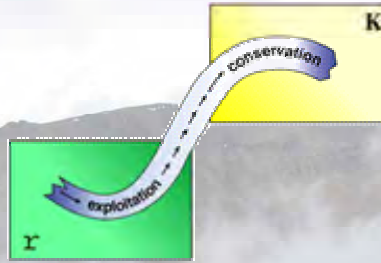
- weak, diffuse controlled largely by external variables
- strong, aggregated control mediates external variables

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**FRONT LOOP  
SLOW VARIABLES**

- growth or exploitation (r)
- conservation (K)



**BACK LOOP  
FAST VARIABLES**

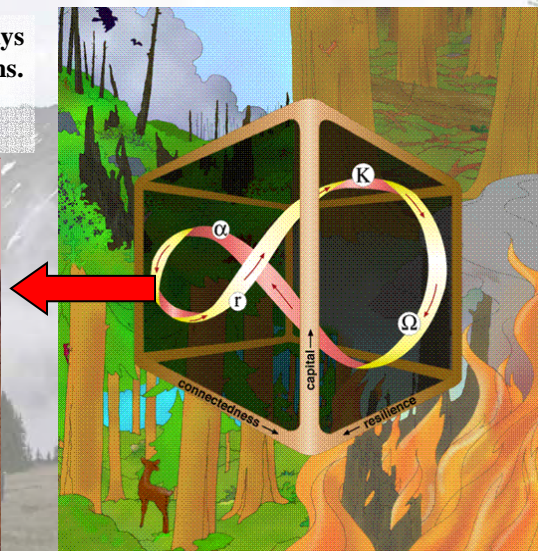
- collapse or release (omega)
- reorganization (alpha)

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Adaptive cycles do not always return to previous conditions. There are a number of alternative stable states



Large areas on Upper Greybull forests burned in 1790s > flipped to open grassland.

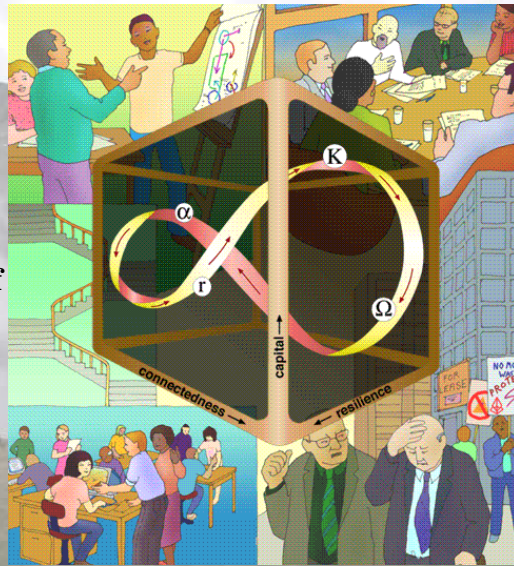


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### Important aspect of adaptive cycles:

- they seem to characterize economic as well as ecological patterns
- can model multiple scalar processes across a variety of research domains

### ECONOMIC CYCLES

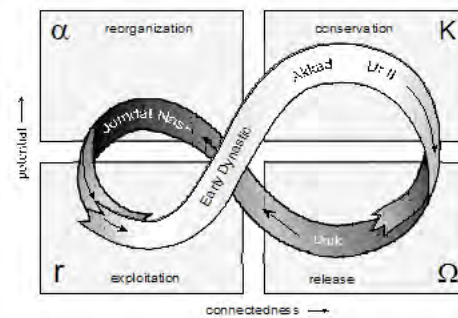


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### Three archaeological examples from Redman (2002) *Deep-time and the Resilience of Socio-ecological Systems.*

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### ADAPTIVE CYCLE AMONG EARLY MESOPOTAMIAN SOCIETIES

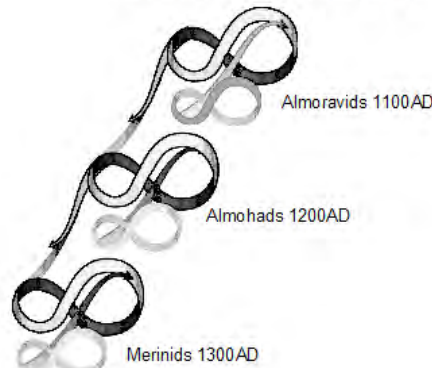


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Three archaeological examples from Redman (2002)  
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REPEATED CYCLES OF NORTH AFRICAN DYNASTIES

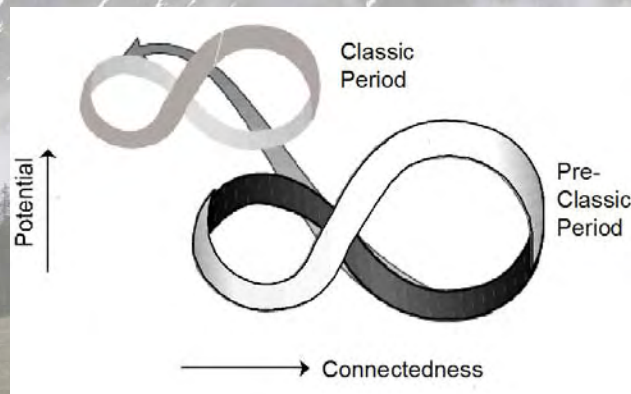


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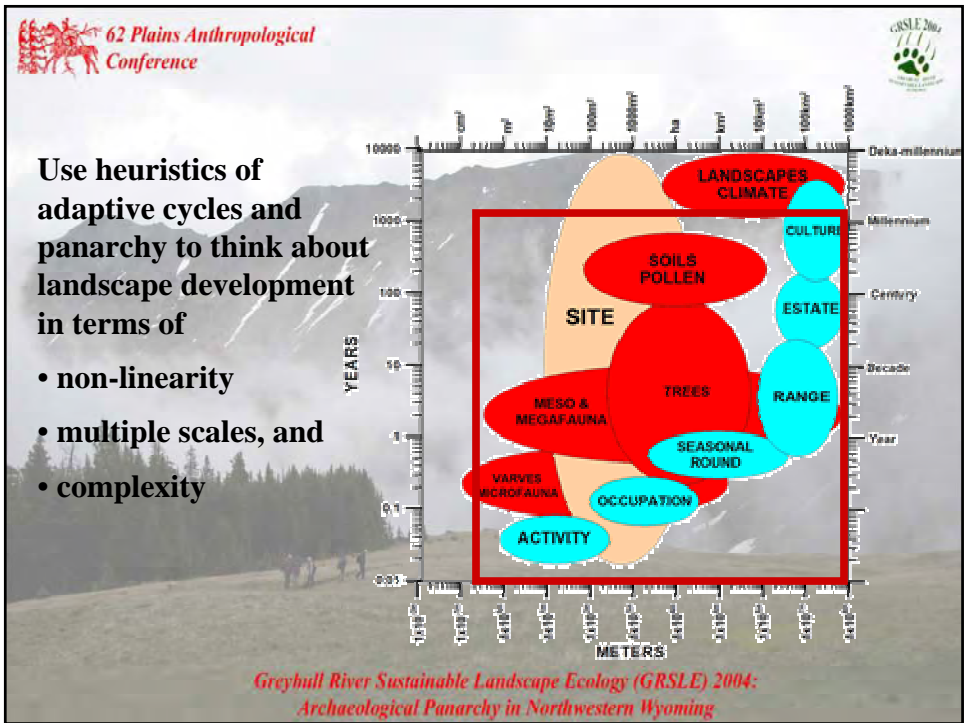
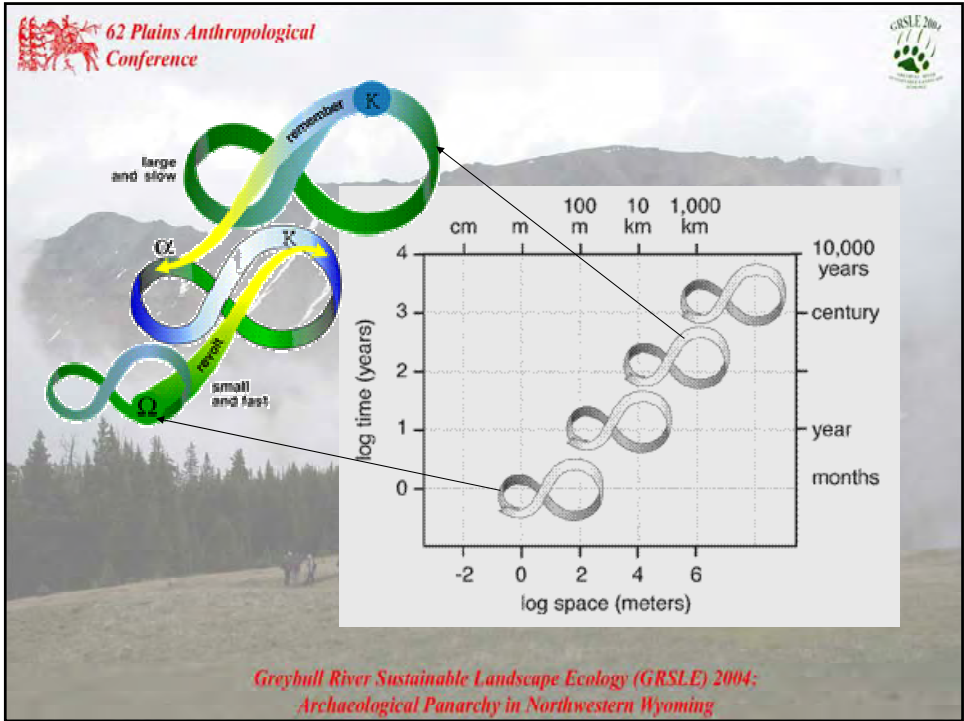
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Hohokam



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Late Prehistoric



**SLOW VARIABLES**  
~500 to ~1800

r to K (exploitation > conservation):  
Mountain landuse pattern built up across a series of perturbations

- accumulation of cultural capital
- repetitive use of landscapes
- responsiveness to regional fluctuations (inter-basin variation)

**FAST VARIABLES**  
1790's to early 1800's

$\Omega$  to  $\alpha$  (release > reorganization):  
Severe, unpredictable external stresses exceed the system's adaptive resilience

- severe population loss
- extreme loss of cultural capital
- new attractors – horses
- new attractors -- trade goods
- indications of severe fires
- new system state with limited human presence

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Late Prehistoric



**SLOW VARIABLES**  
~1800 to 1880

r to K (exploitation > conservation):  
Mountain landuse reorganization with limited cultural input

- predator/prey readjustments
- meadow/camp site revegetation
- snag/small fuel wood rejuvenation

**FAST VARIABLES**  
1880 to 1890

$\Omega$  to  $\alpha$  (release > reorganization):  
Livestock and big game hunting economy created

- Ranching into the Basin
- Summer grazing
- Fall/Winter hunting
- new system state with limited numbers of people, but large numbers of livestock

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**FAST VARIABLES**  
~1990-2XXX

$\Omega$  to  $\alpha$  (release > reorganization):  
Large Ranches decline, greater recreational potential

- diminished traditional economy
- increased land values
- amenities lifestyles
- recreational use increase

**SLOW VARIABLES**  
1890 to ~1900

r to K (exploitation > conservation):  
Mountain landuse primarily grazing and big game hunting

- predator elimination
- regulated hunting
- grazing allotments
- Agency controls
- 1964 Wilderness

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**Currently Pan is active in the  $\Omega$  to  $\alpha$  backloop and landuse is flipping from a ranching economy to “something else”**

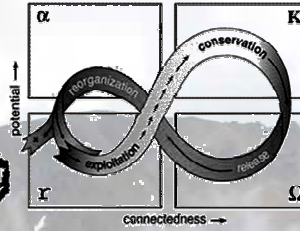
**ALTERNATIVE FUTURES**

1780 1870 1990

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afternoon**



## Wahb discovers Panarchy

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