

Ecosystem health demystified

*An ecological concept
determined by economic means*

By E.J.S. Hearnshaw, R. Cullen & K.F.D. Hughey
Lincoln University

Ecosystem health...

- *Ecosystem health* is seen as the way forward for environmental management
- *Ecosystem health* makes that intuitive step of drawing on the human health metaphor and applying it to ecosystems
- After all, a healthy ecosystem provides the “*factors of production*” for life and development

Demarcating ecosystem health

- *Ecosystem health* while popular, remains poorly understood and defined
- After all, has anyone ever seen an *ecosystem*, and is *health* a relevant expression when applied to an ecosystem?
- Thus, the aim of this talk is to demystify *ecosystem health* and to point toward an economic approach to managing ecosystems

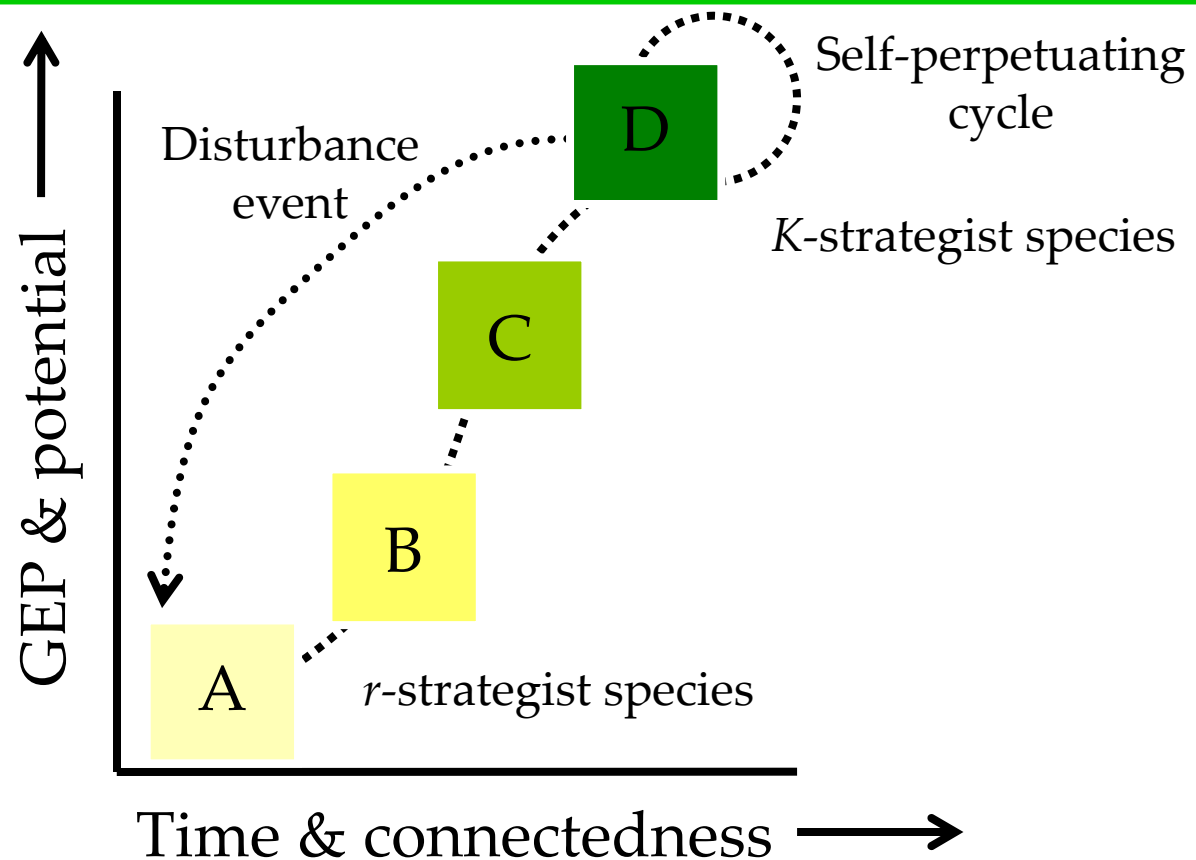
Naturalness, wilderness...

- Naturalness dichotomises the virtues of nature from the vices of human action
- A truly “objective” measure of ecosystem health...?
- Naturalness considers only a static perspective
- Non-natives can restore system functioning
- Humans are part of nature...

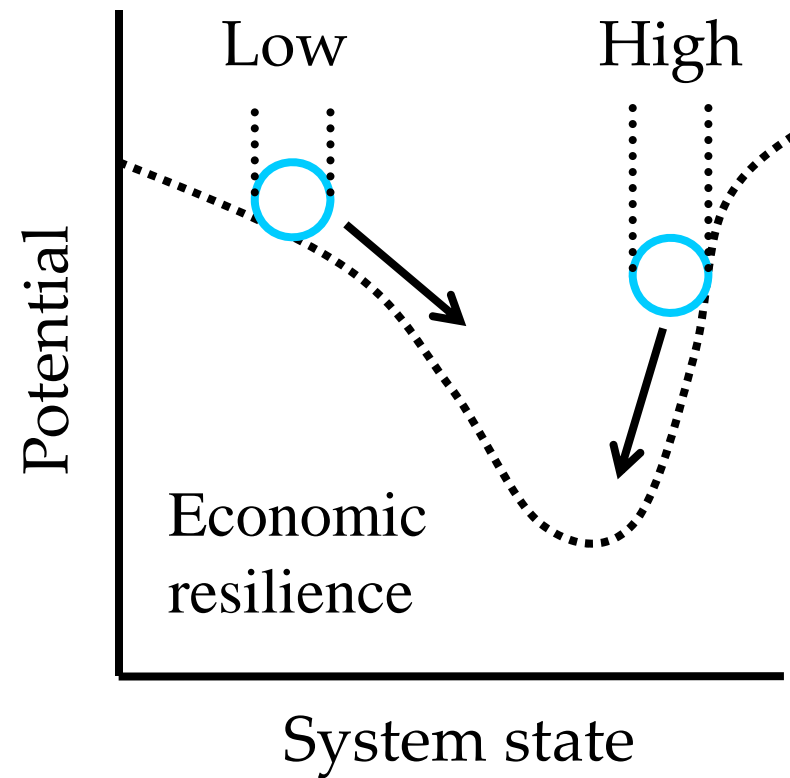
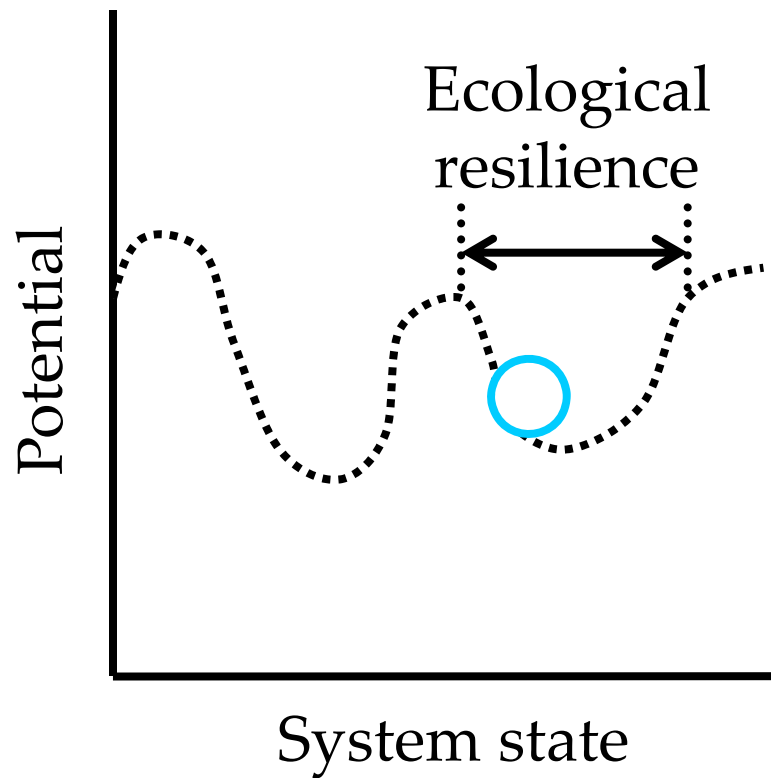
Reductionism...

- Reductionism focuses on finding the “building blocks of nature” \cong genes...
- Neo-Darwinists view *ecosystem health* according to genetic distinctiveness
- Neo-Darwinian perspective cannot explain higher ecological forms found in nature
- Ecosystems are characterised by strong non-linear interactions ~ thus they cannot be simply summed from their parts

Succession-to-climax...



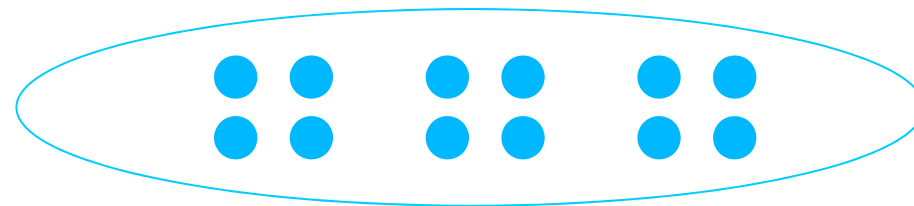
Non-linearity and resilience...



Stability and diversity...

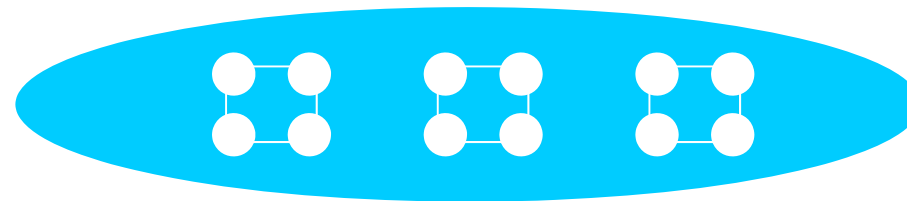
- Diversity-stability hypothesis is the most legitimate argument for preserving diversity
- But, diversity-stability is a multidimensional relationship...
- Resilience-diversity relationship unknown, but 'driver species' hypothesis possible
- However, evidence suggests ecosystems are independent of the species they contain
- $EHI = Connectedness \times Potential \times Resilience$

Self-organisation and emergence...



Local interactions

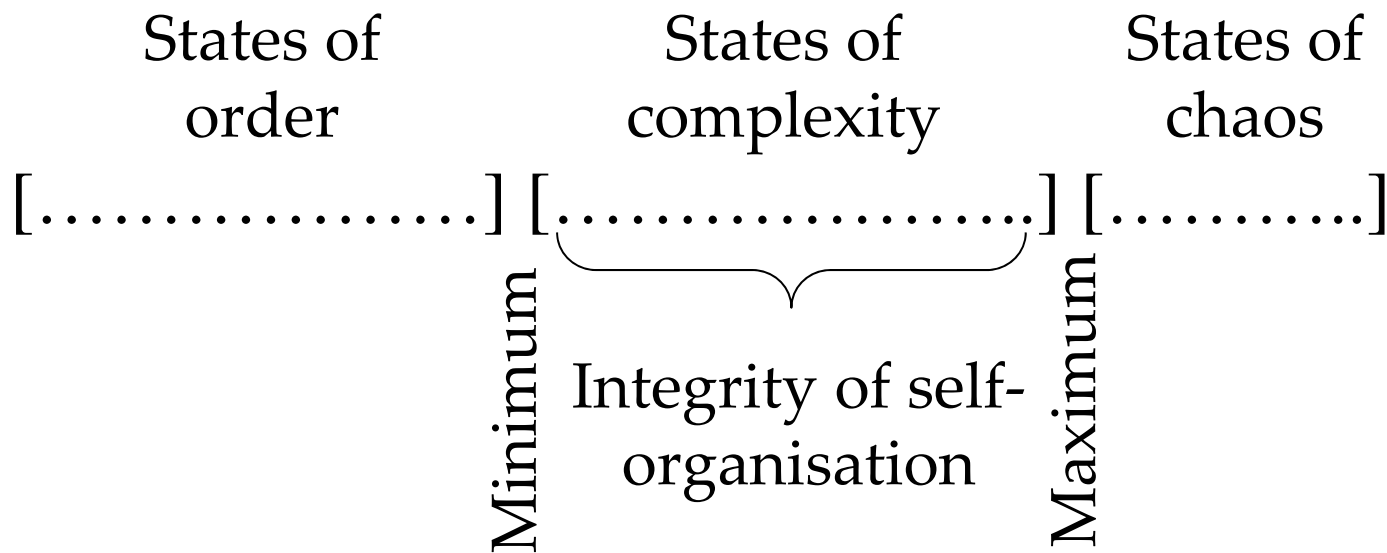
Positive and negative feedback



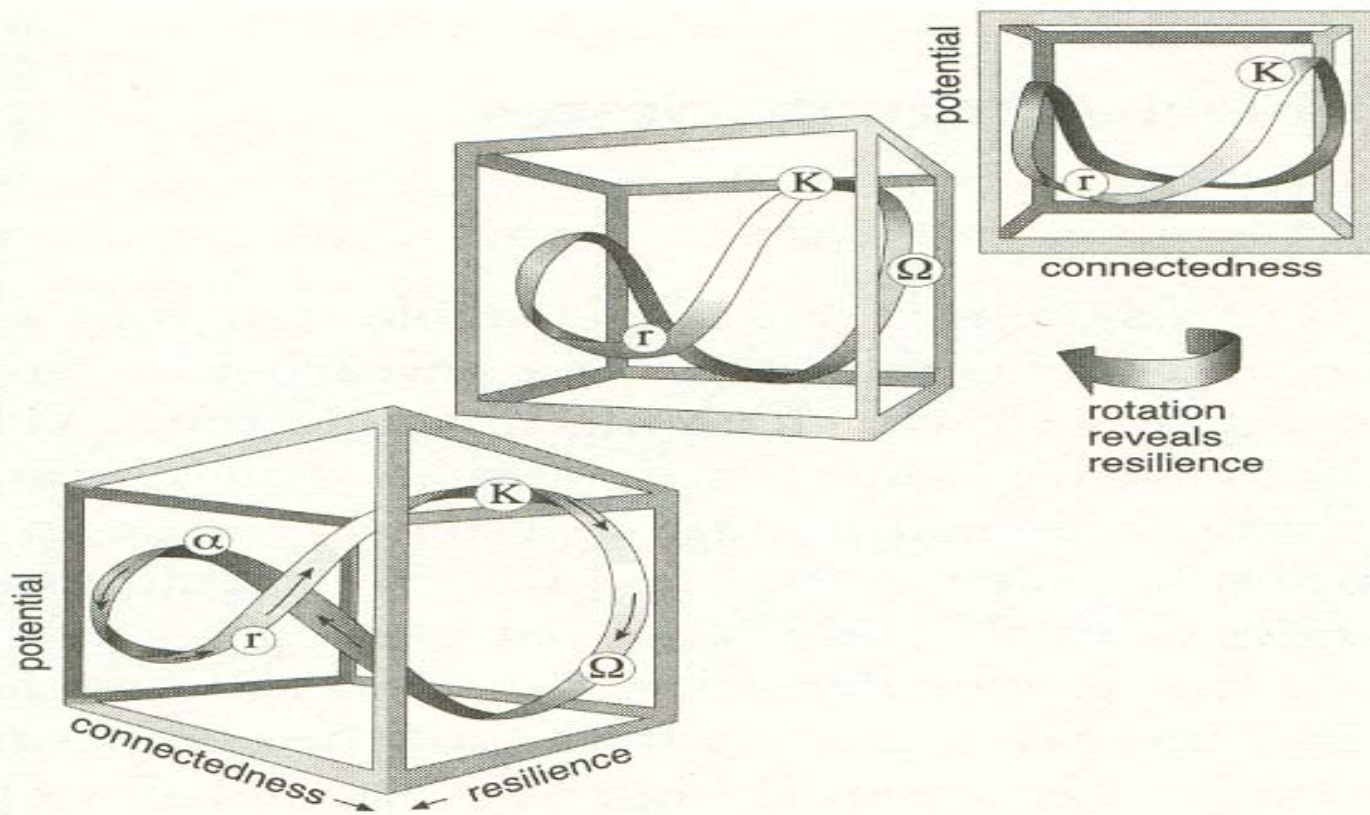
Global properties

Complexity...

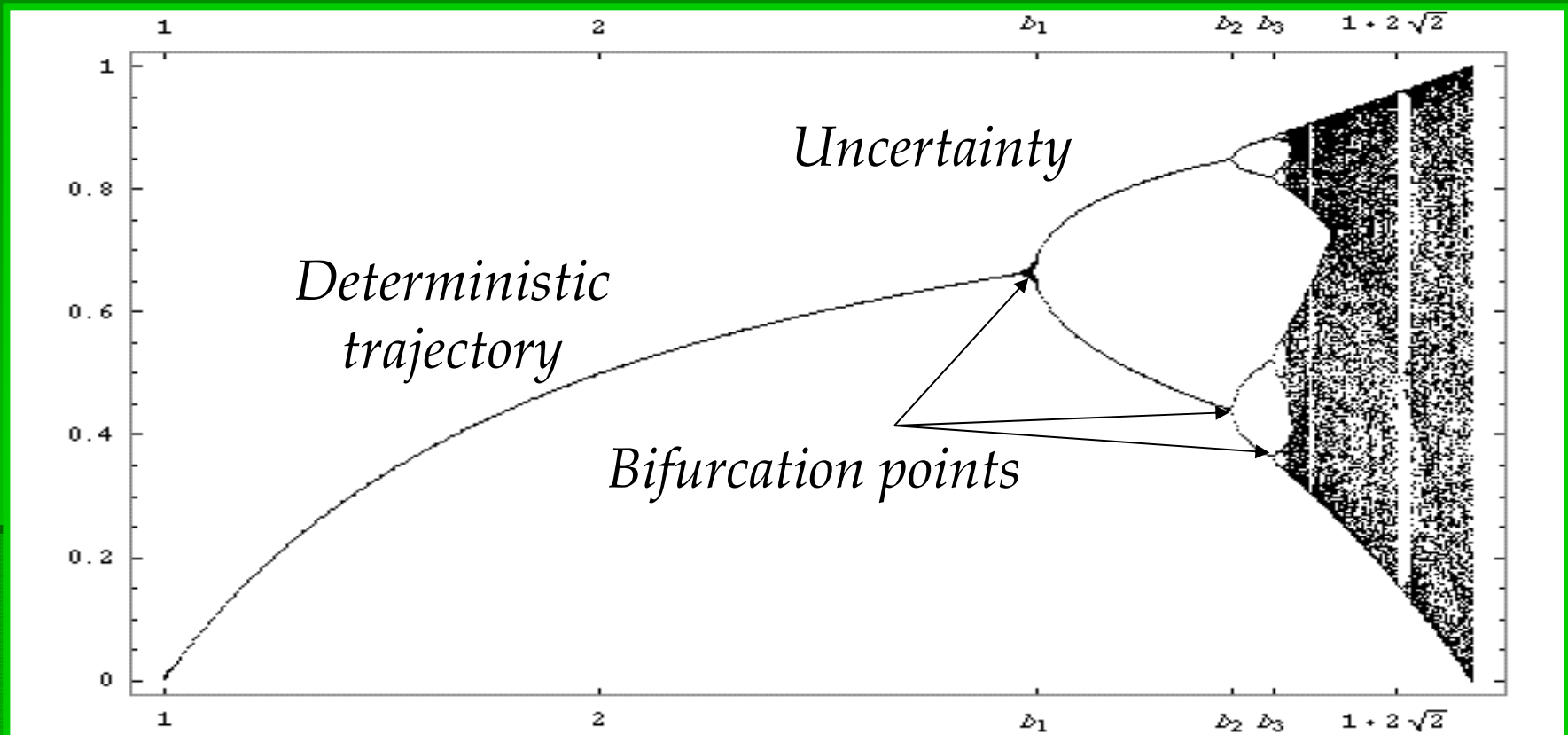
The axis of state space



Adaptive cycle...



Bifurcations and uncertainty...



Social utility...

- We can no longer presume that naturalness, diversity and stability are “good”
- We must accept that there is no state that is ecologically “better” within a system
- Science cannot resolve which state is “right” ...
- Decisions concerning *ecosystem health* should be determined by the preferences of society
- We must ask ourselves “what kind of ecological garden do we want and get?”

Change and adaptation...

- We must accept that “change” is inevitable, but unpredictable
- Enhancing a desired state’s resilience is not seen to be useful as the desirable state may become undesirable as preferences change
- The most appropriate means to proceed is to experiment, adapt and to react to changes as they become apparent

The way ahead

- The human health analogy has already been used. CUA for single and multi species projects
- Can we extend those approaches to manage ecosystems?
- What will be needed to operationalise?
- Need to know: Social preferences, ecological possibilities, \$ available to manage ecosystems as society chooses
- ECOPY to be trialled on two ecosystems