

# **Ecosystem services, global change and the role of mainstream ecologists**

**Dave Raffaelli**

**BES/YESI meeting**

**University of York 8<sup>th</sup>-9<sup>th</sup> April 2013**

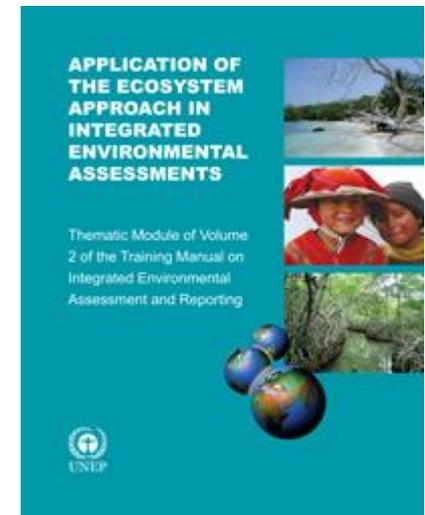
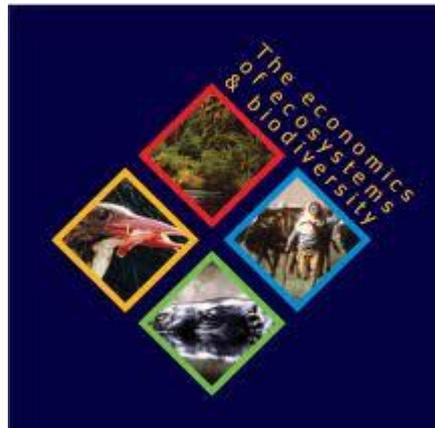
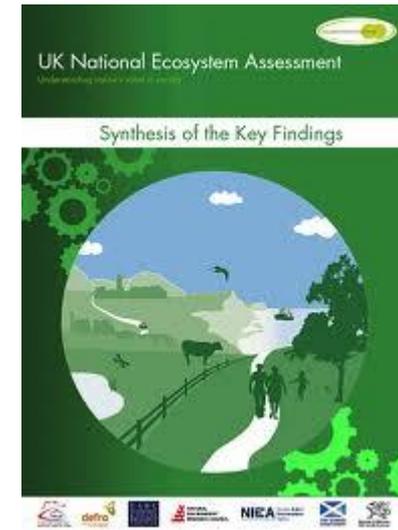
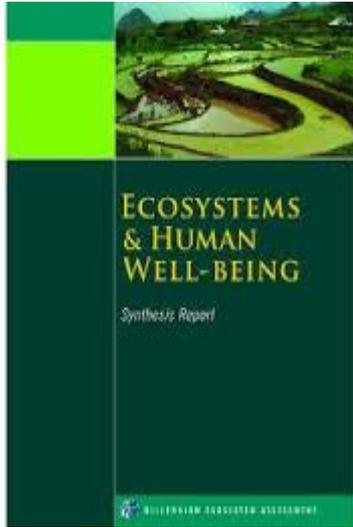


**Oh god, he's even got the beard.....**

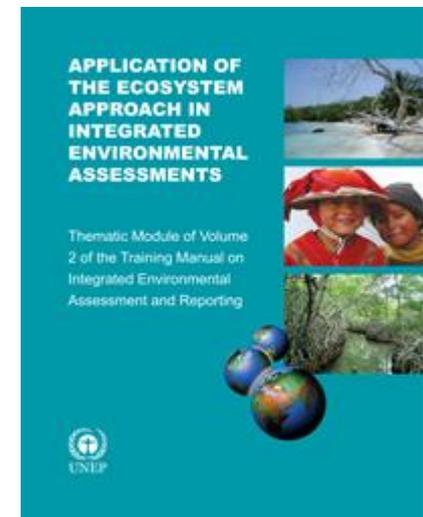
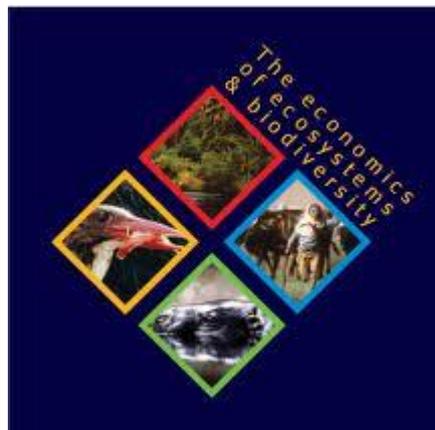
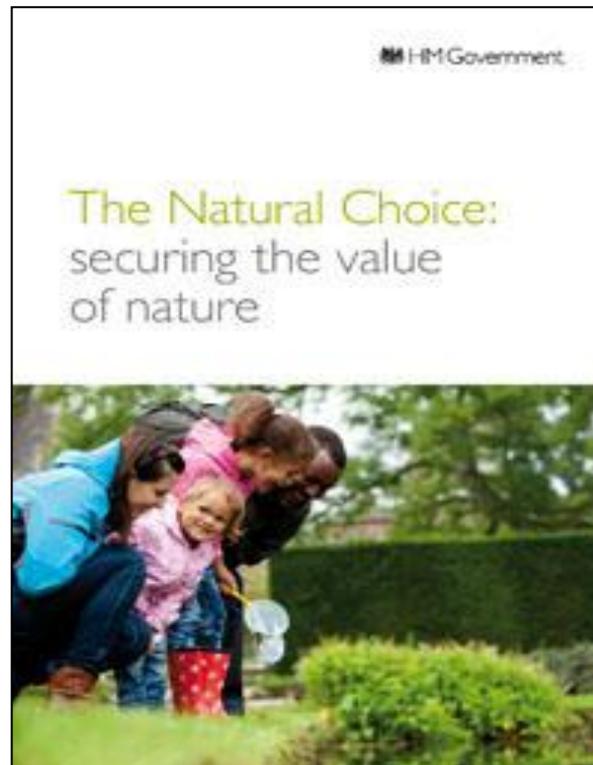
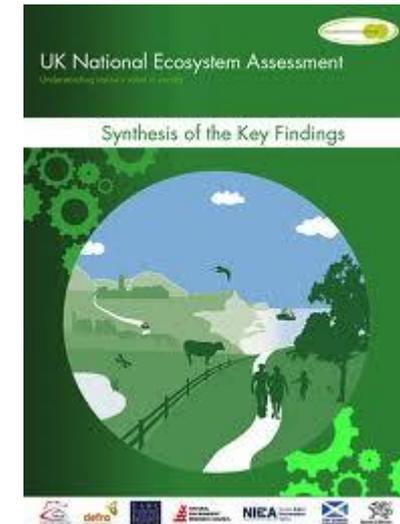
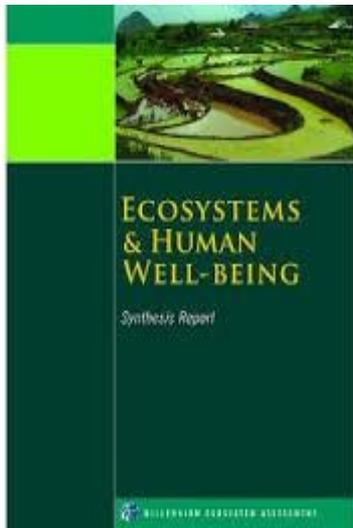
**How does she manage without a Swiss Army knife and a woolly hat?**



# The Ecosystem Approach

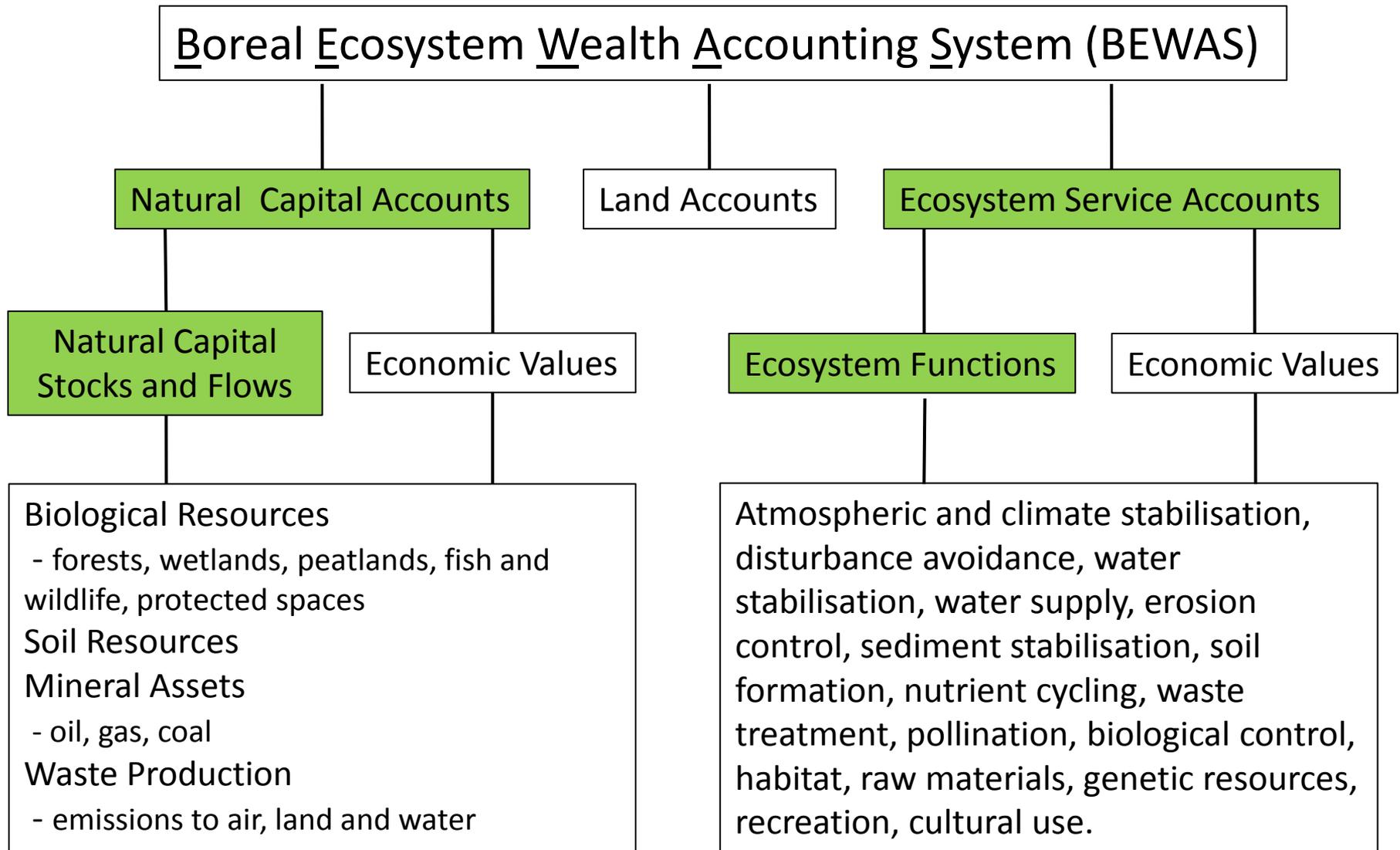


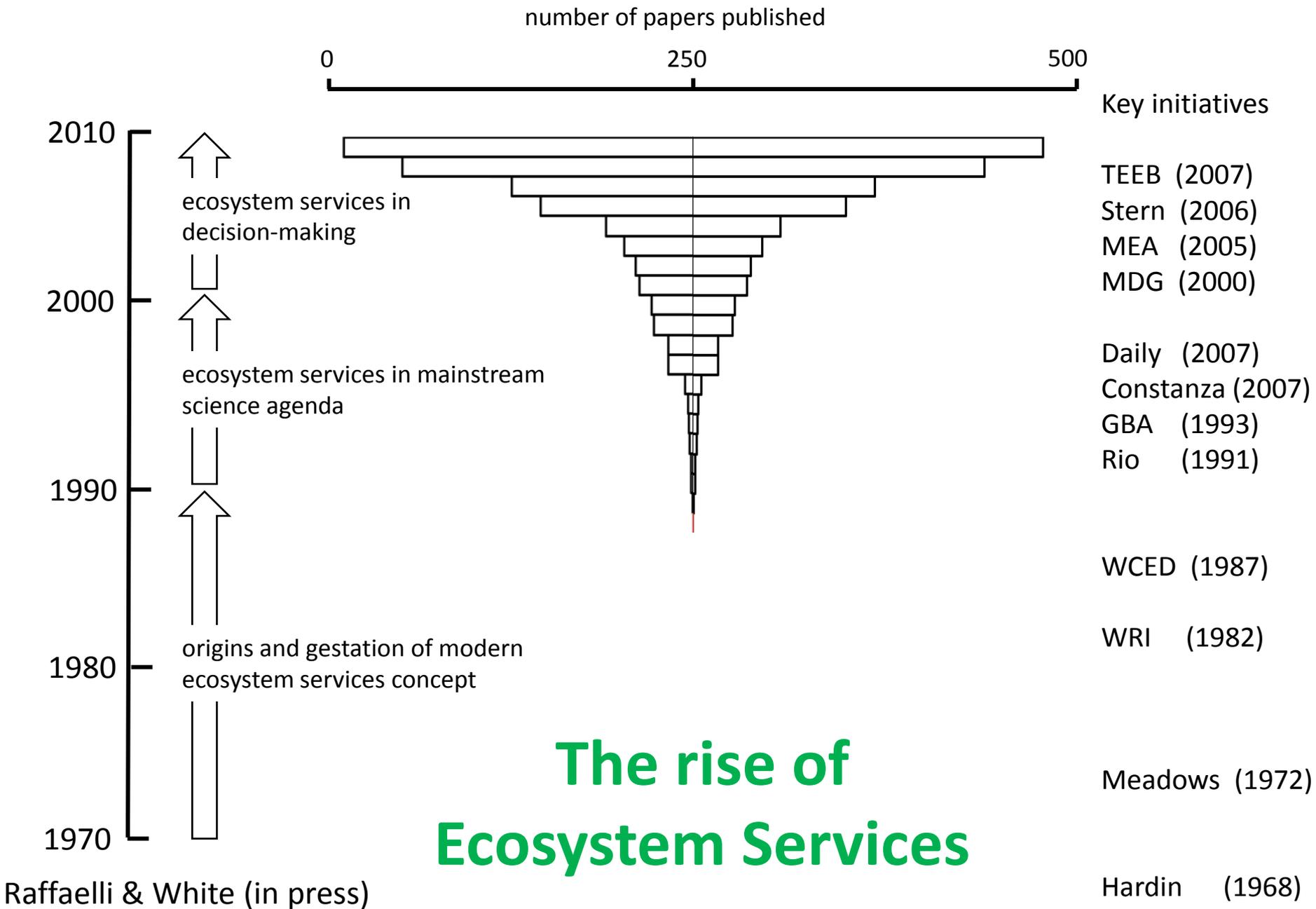
# The Ecosystem Approach



# National Resource Accounting

Anielski and Wilson (2006)





# What can mainstream ecologists offer?



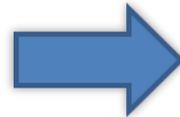
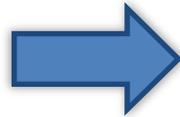
British Ecological Society  
— CELEBRATING 100 YEARS —



# Here's what: capital stocks and service flows

**Stocks:** the ecosystem structure and processes and links to the abiotic environment.

**Flows:** outcomes from the functioning of ecosystems of significant value (benefits) to human society.



# Key questions for ecologists to answer

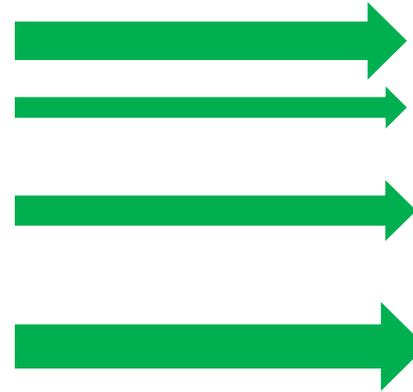
1. What are the **relationships between capital stocks and flows** of services?

2. How will future **global drivers** affect stocks and flows?

3. What **tools and metrics** can be developed to measure trends in stocks and flows?



**Natural Capital Stock**



**Flows of ecosystem services**

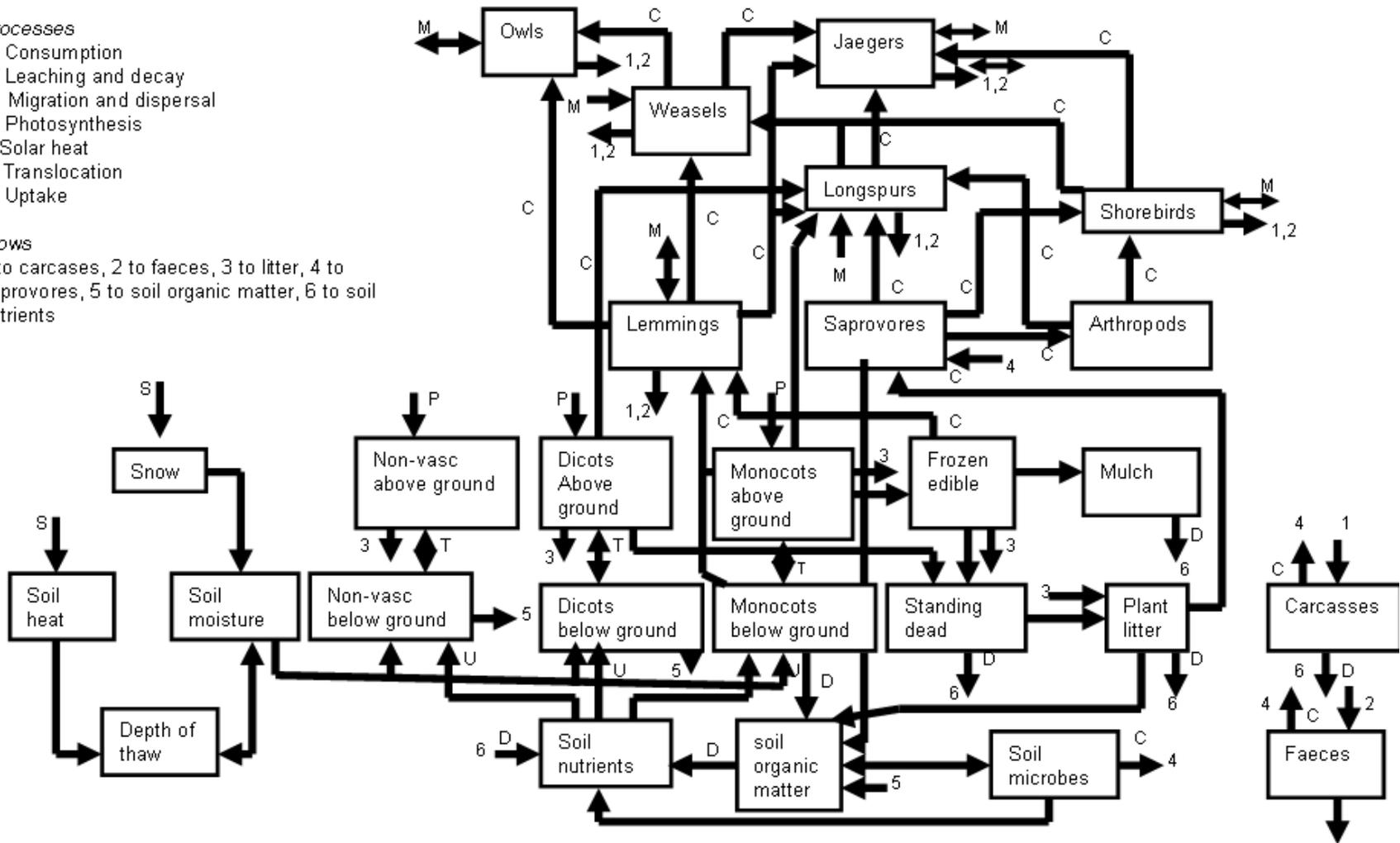
# Putting the system back into Ecosystem

## Processes

- C Consumption
- D Leaching and decay
- M Migration and dispersal
- P Photosynthesis
- S Solar heat
- T Translocation
- U Uptake

## Flows

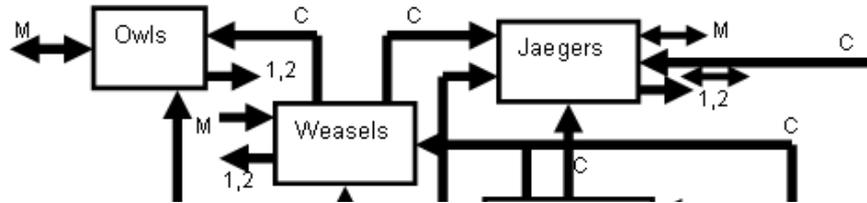
- 1 to carcasses, 2 to faeces, 3 to litter, 4 to saprovores, 5 to soil organic matter, 6 to soil nutrients



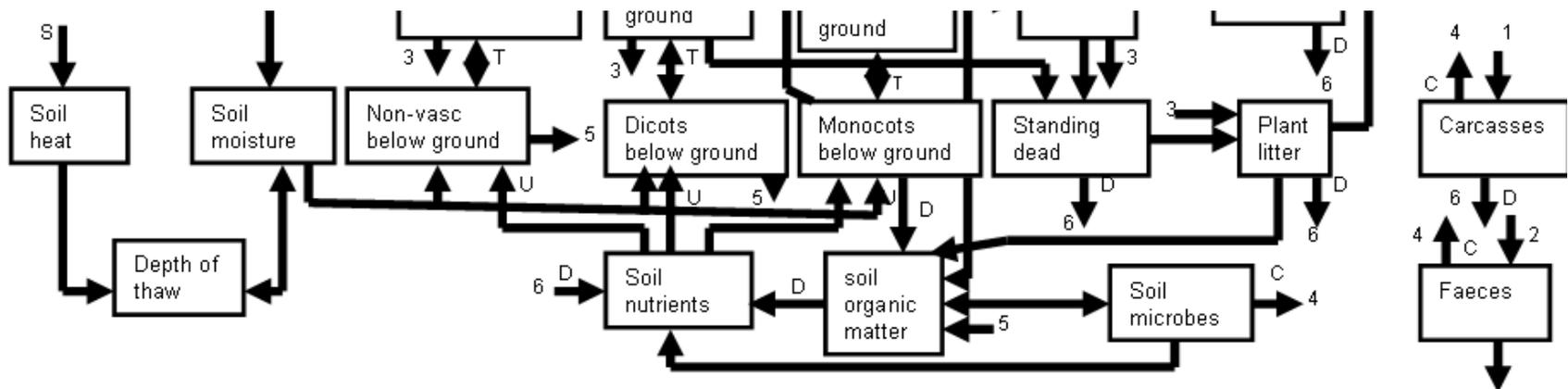
# Putting the system back into Ecosystem

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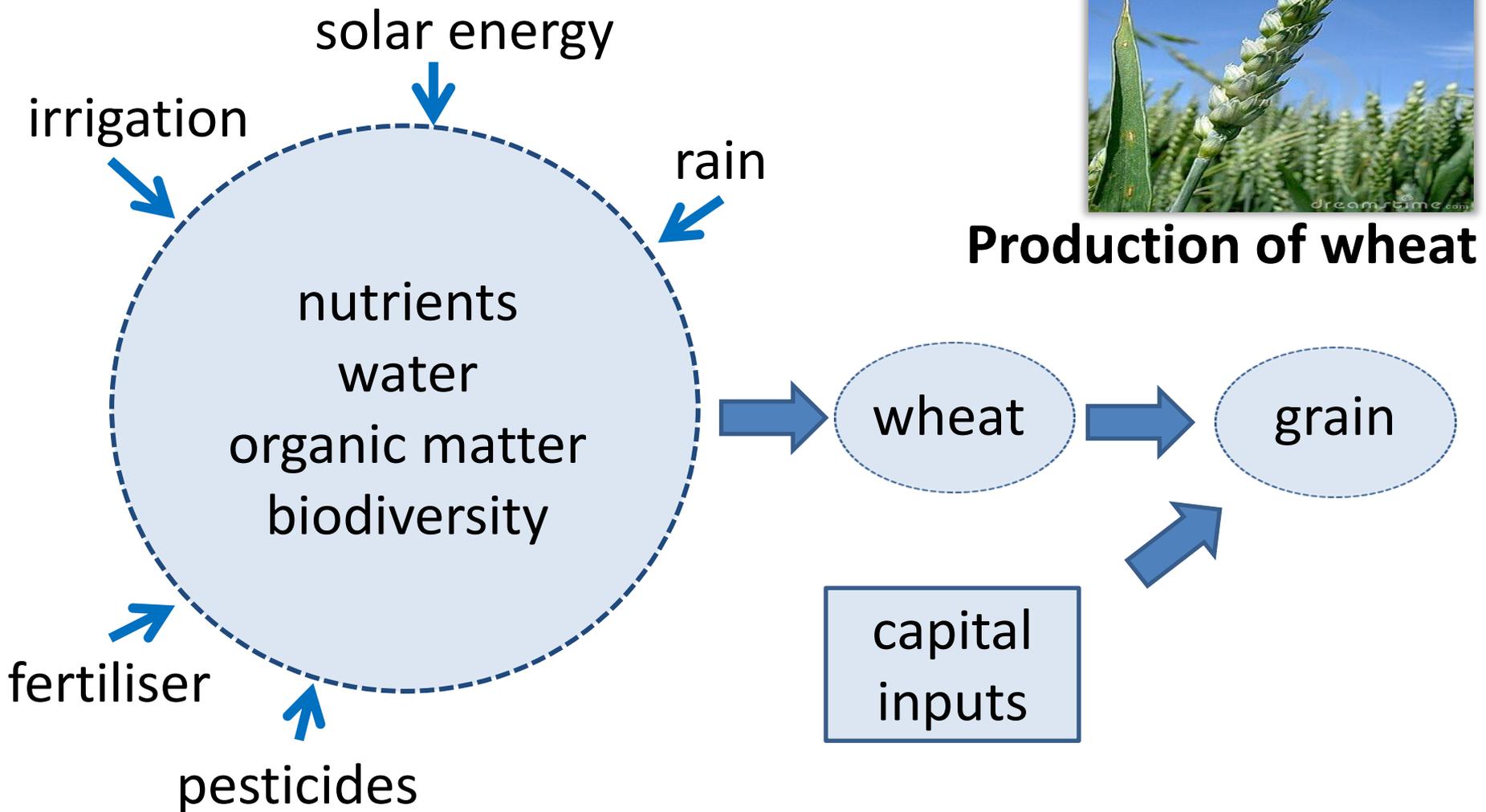


stocks and flows are the stuff of ecosystem ecology



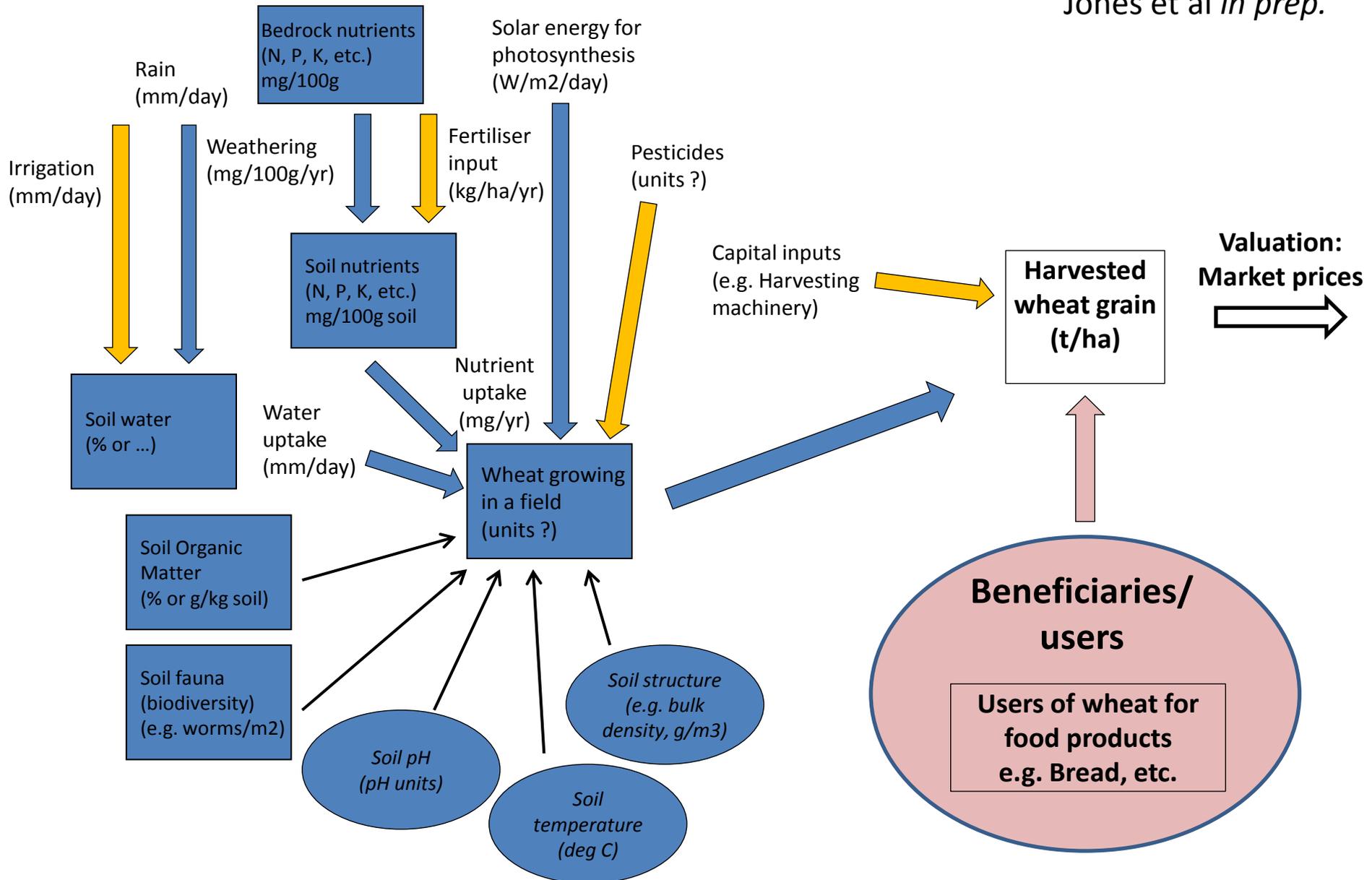
Point Barrow, Alaska, from Worthington (1975)

# Systems framework linking stocks and flows: unpacking the “stock-box”



# The fine detail.....

From Laurence Jones et al *in prep.*



# Why has systems ecology been neglected?



# Systems ecology has unfamiliar concepts



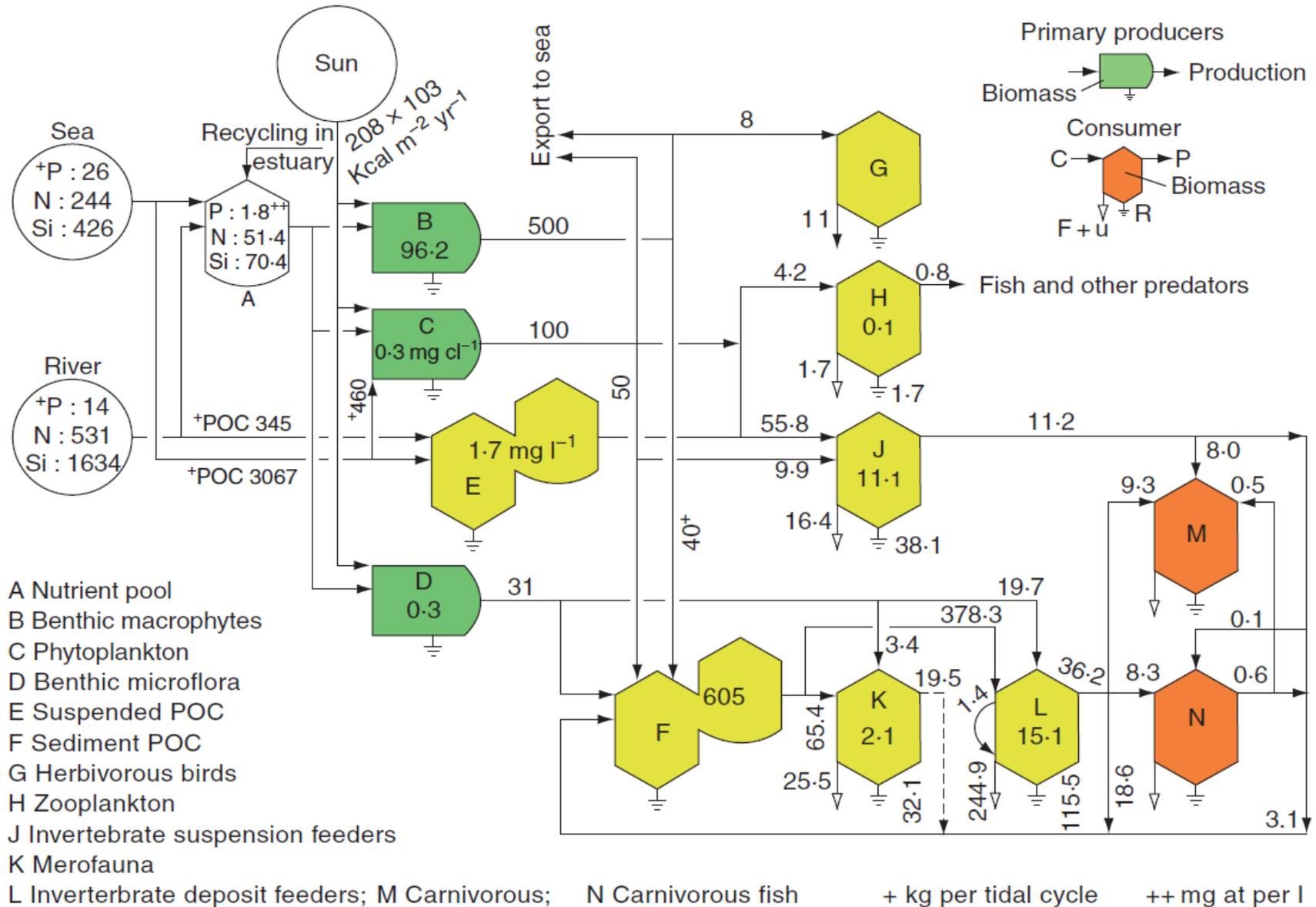
Odum School  
of Ecology  
The University of Georgia

Ecosystems do work  
They are goal directed

Exergy, System Overhead, Ascendancy  
Windows of Vitality, Emergy.....

The holistic approach was seen as “*blasphemous....and not to be trusted in a world where reductionism and small scale biology held rein*” (Brown et al. 2004).

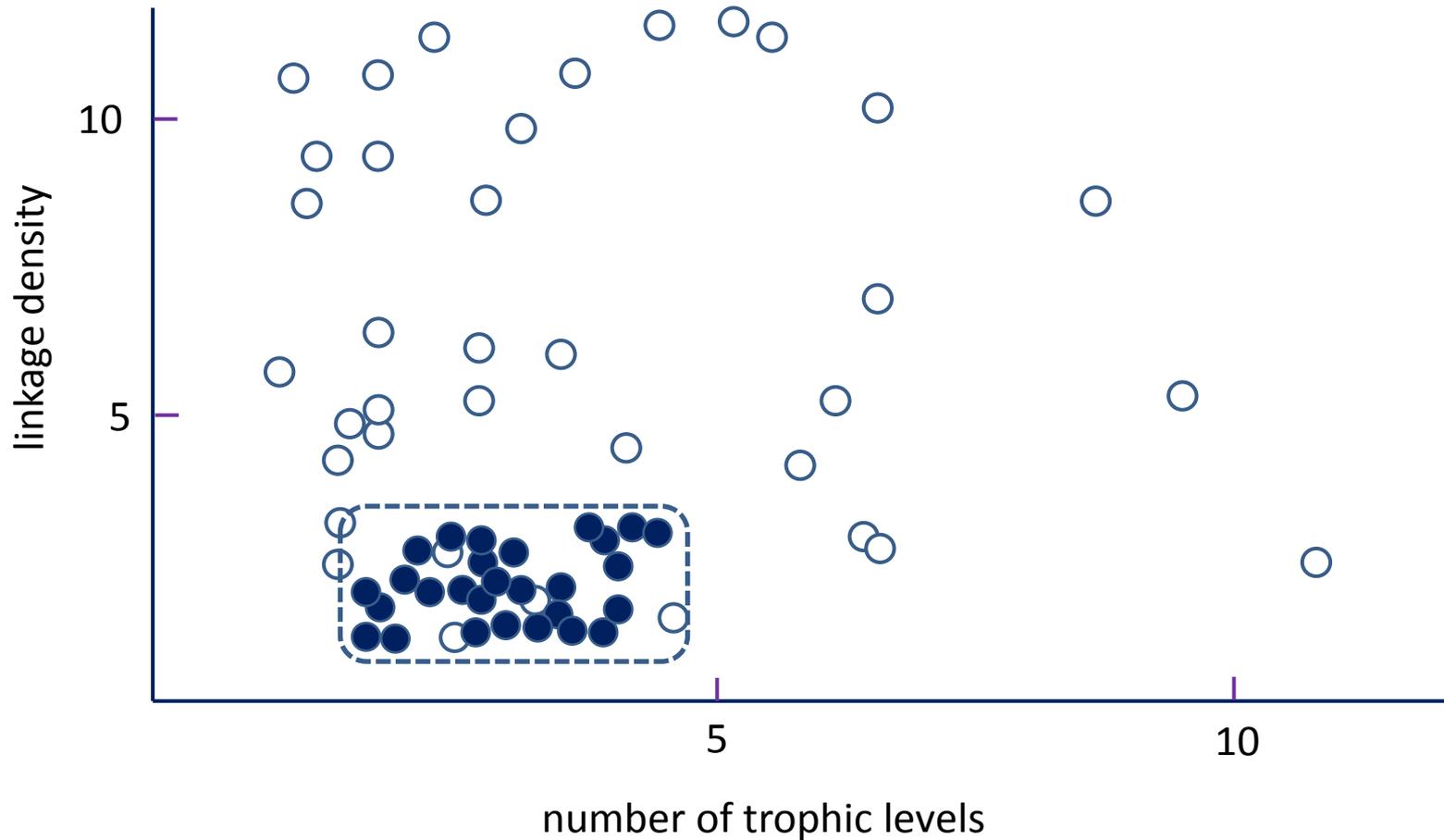
# Systems ecology also loves horrendo-grams





# What effect do trade-offs of services have on the system?

## Ulanowicz' Window of Vitality



# Reductionist approaches: Biodiversity and Ecosystem Functioning

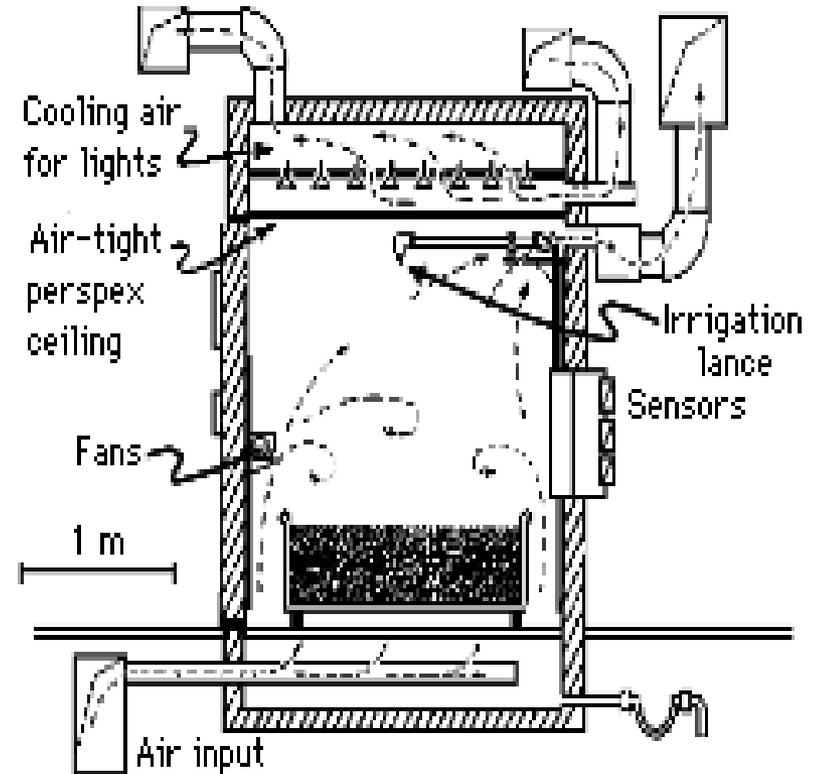


Typified by Cedar Creek and BioDEPTH grassland projects:

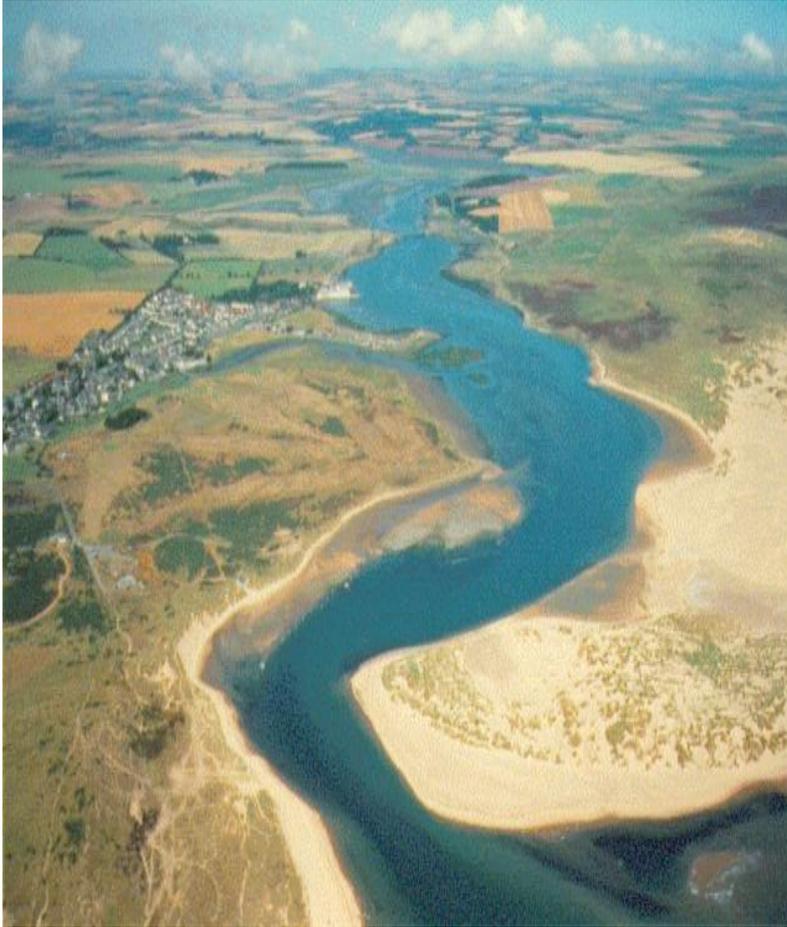
1. Create plots with different numbers of plant species
2. Measure ecosystem function (process) in each plot



# Reductionist approaches: The Ecotron at Imperial College

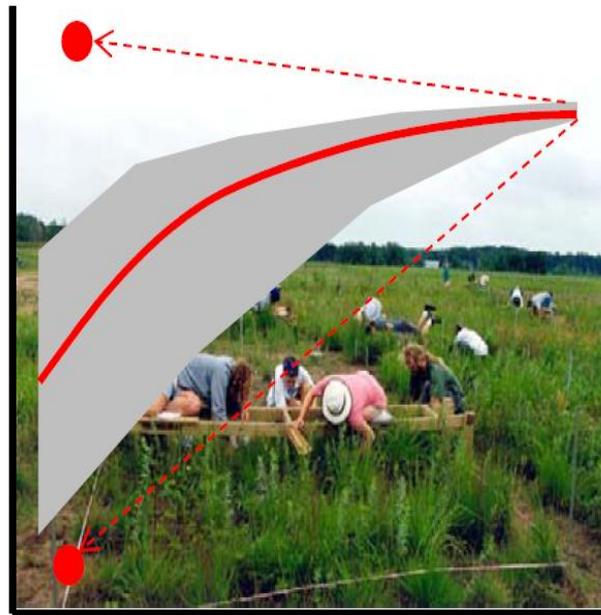


# Reductionist approaches: The Mudotron at Aberdeen

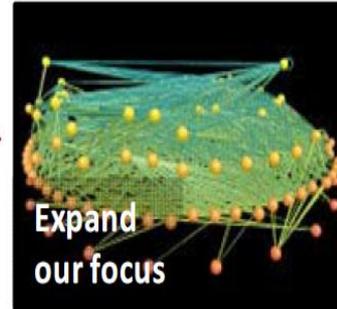


# Extending BEF experiments to ecosystem services

**Ecosystem function**  
(resource capture, biomass production, decomposition, nutrient recycling)



**Biological diversity**  
(variation in genes, species, functional traits, habitats)



**But just doing the science isn't enough:**

**Ecologists must engage with other disciplines**

**Ecological science's voice needs to be heard**



# environmental decision making

# environmental decision making

## Balance sheet 1 economic analysis

- Individualism and self-interest motivation
- Economic Cost-Benefit Analysis
- Distributional effects: actual compensation
- Behavioural economics: social networks, etc.
- Group dialogue before individual valuation
- Green national income accounts
- Comprehensive wealth concepts

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## Balance sheet 2 regional and local impact analysis

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- Local economic multipliers
- Symbolic and cultural asset loss
- Social capital loss

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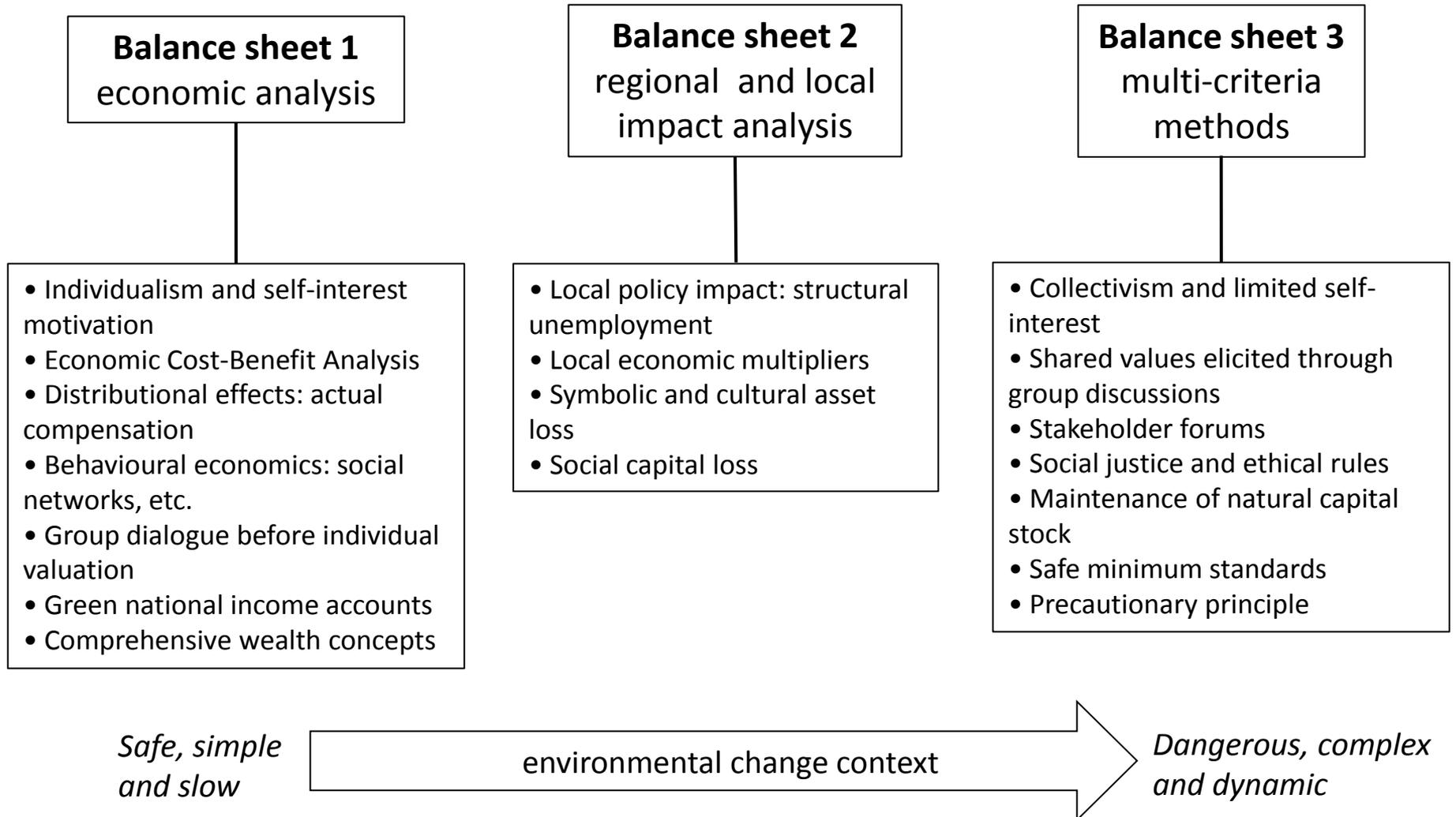
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## Balance sheet 3 multi-criteria methods

- Collectivism and limited self-interest
- Shared values elicited through group discussions
- Stakeholder forums
- Social justice and ethical rules
- Maintenance of natural capital stock
- Safe minimum standards
- Precautionary principle

# environmental decision making



After Kerry Turner (in press)



OK, but the beard will have to go

The things one has to do to save the planet

**engagement is everything**