Catchment Systems Science: underpinning management frameworks

Paul Quinn

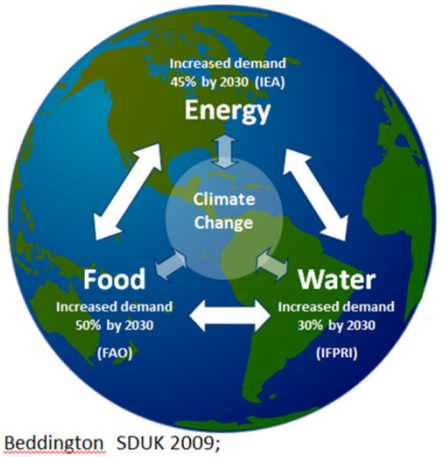
And

Kit Macleod

Catchment Systems Science

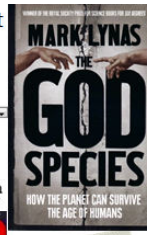
Government Office for Science

‘Perfect storm’



Beddington SDUK 2009;
Oxford Farming Conference 2010

“Nature no longer runs the earth. We do. It is our choice what happens from here” (Lynas 2011:p8).



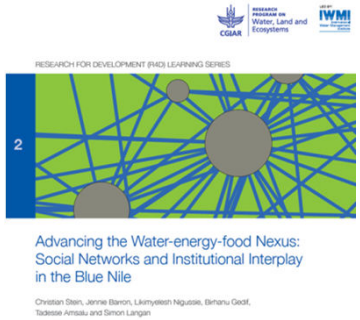
“The truth is that global environmental problems are soluble” (Lynas 2011:p244).

UNITED NATIONS
ECONOMIC COMMISSION
FOR EUROPE

08–09 Sep 14

MEETING

Reconciling different uses of water - work on the nexus in transboundary basins

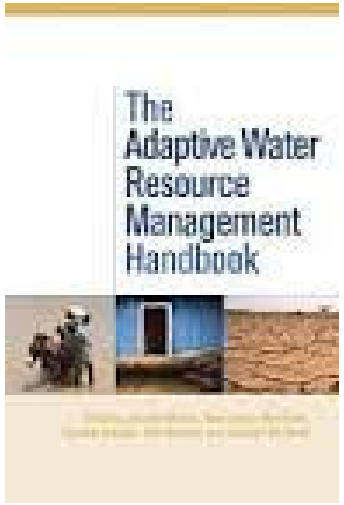


IWRM/AWM

IWRM ‘A process which promotes the coordinated development and management of water, land and related resources in order to maximise the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems’ (GWP 2000).

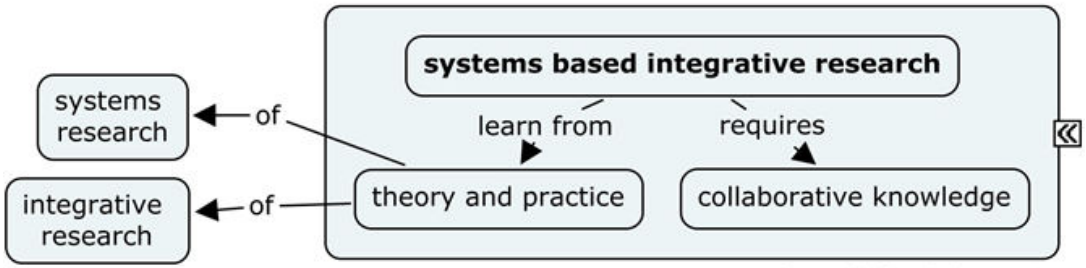
NeWater

New Approaches to Adaptive Water Management under Uncertainty

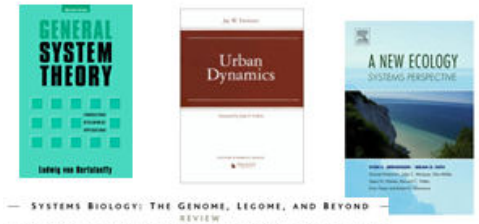


AWM in the context of IWRM “provides added value through explicitly embracing uncertainty. ***AWM acknowledges the complexity of the systems*** to be managed and the limits in predicting and controlling them. ***This implies an integrated management approaches which adopt a systemic perspective rather than dealing with individual problems in isolation.*** “

Systems – and emergent properties



International Environmental Modelling and Software Society (iEMSs)
2010 International Congress on Environmental Modelling and Software
Modelling for Environment's Sake, Fifth Biennial Meeting, Ottawa, Canada
David A. Swayne, Wanhong Yang, A. A. Voinov, A. Rizzoli, T. Filatova (Eds.)
http://www.iemss.org/iemss2010/index.php?n=Main.Proceedings

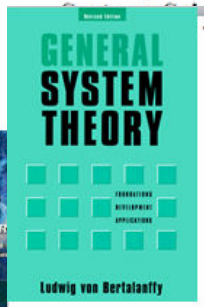


SYSTEMS BIOLOGY: THE GENOME, LEGOME, AND BEYOND
REVIEW

Systems Biology: A Brief Overview

Hiroaki Kitano 1 MARCH 2002 VOL 295 SCIENCE

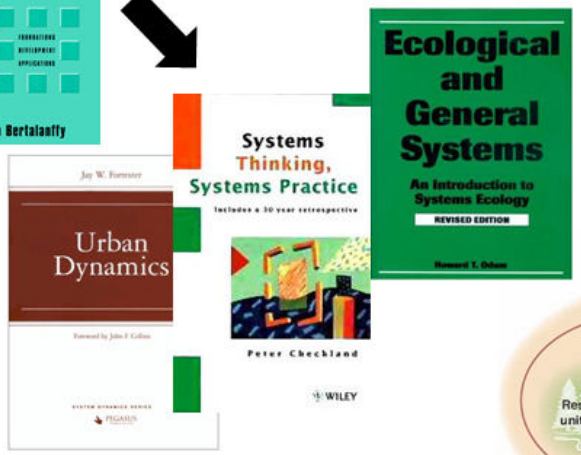
What Can We Learn From Systems Based Approaches: From Systems Biology to Earth



The Use and Abuse of Vegetational Concepts and Terms

A. G. Tansley

Ecology, Vol. 16, No. 3. (Jul., 1935), pp. 284-307.

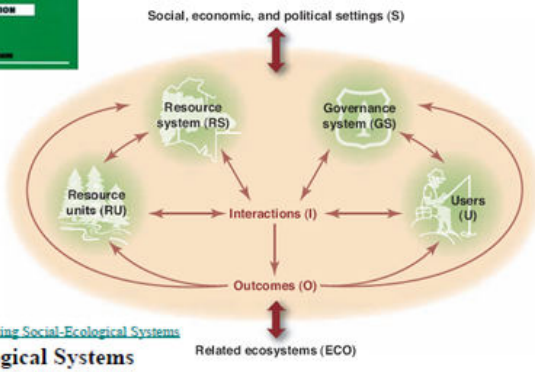


PERSPECTIVE

A General Framework for Analyzing Sustainability of Social-Ecological Systems

Elinor Ostrom[1,2]*

SCIENCE VOL 325 24 JULY 2009



Journal of Advances in Modeling Earth Systems

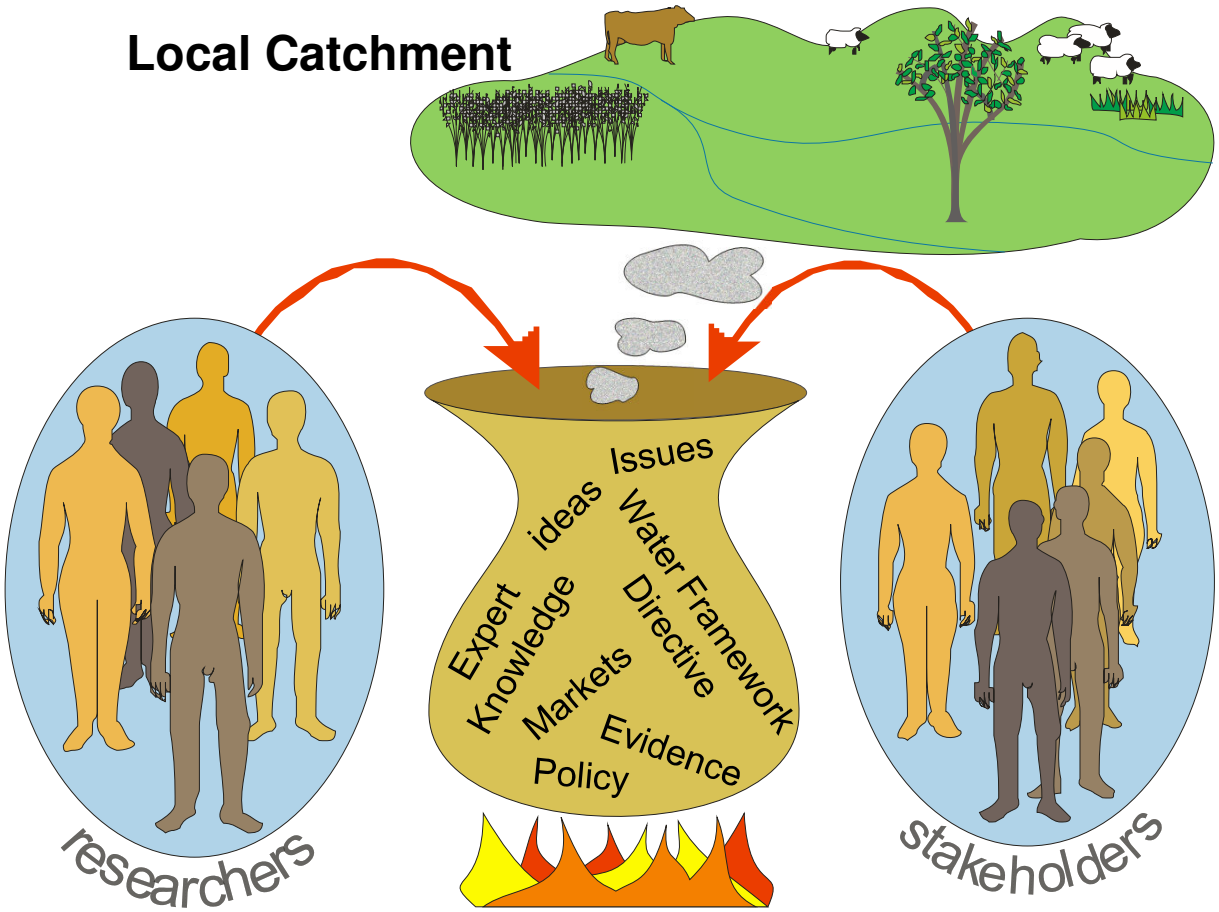
Research, part of a Special Feature on A Framework for Analyzing, Comparing, and Diagnosing Social-Ecological Systems

Comparison of Frameworks for Analyzing Social-ecological Systems

Claudia R. Binder[1], Jochen Hinkel[2], Pieter W. G. Bots[3] and Claudia Pahl-Wostl[4]

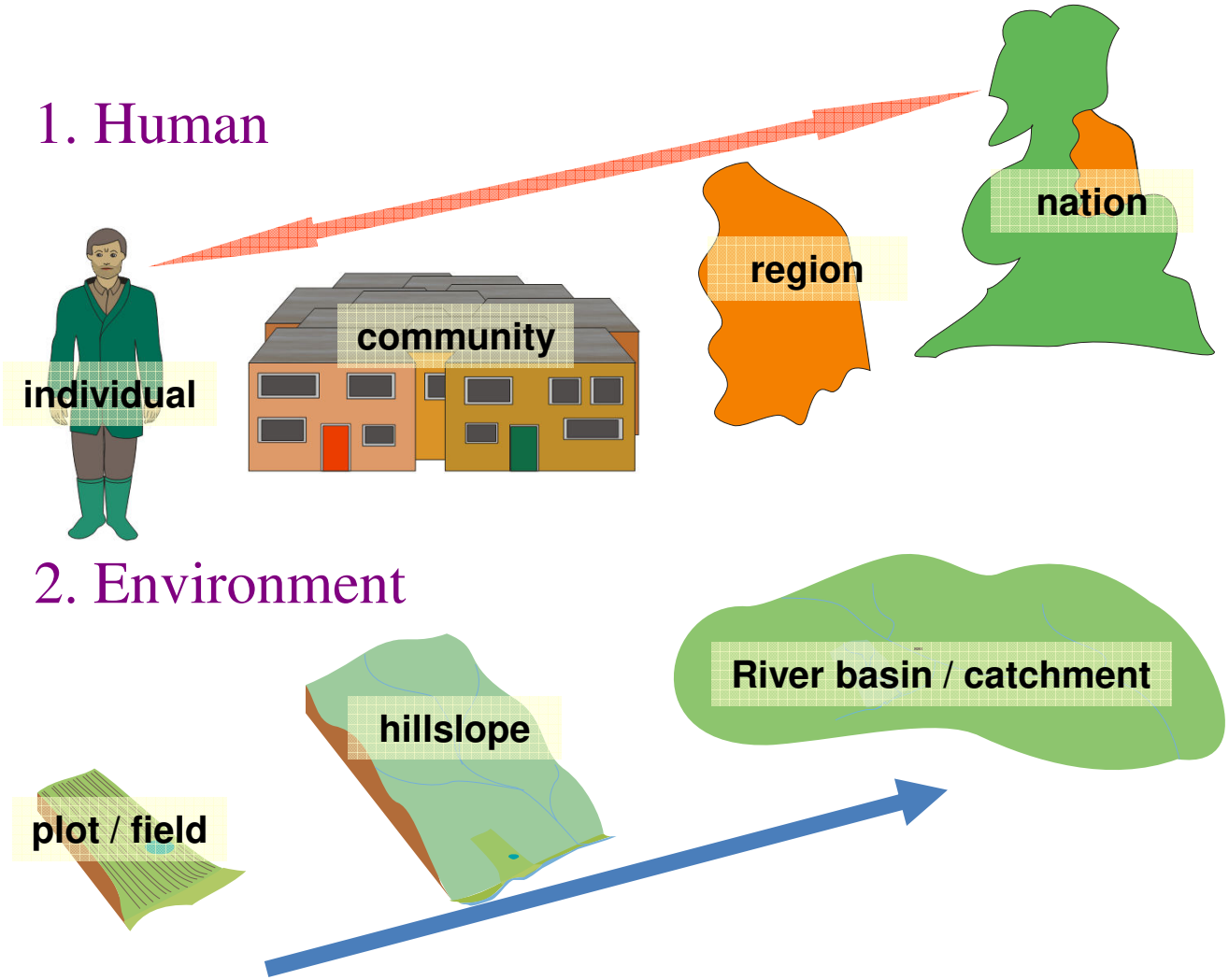
SYSTEMS BIOLOGY: THE GENOME, LEGOME, AND BEYOND
REVIEW

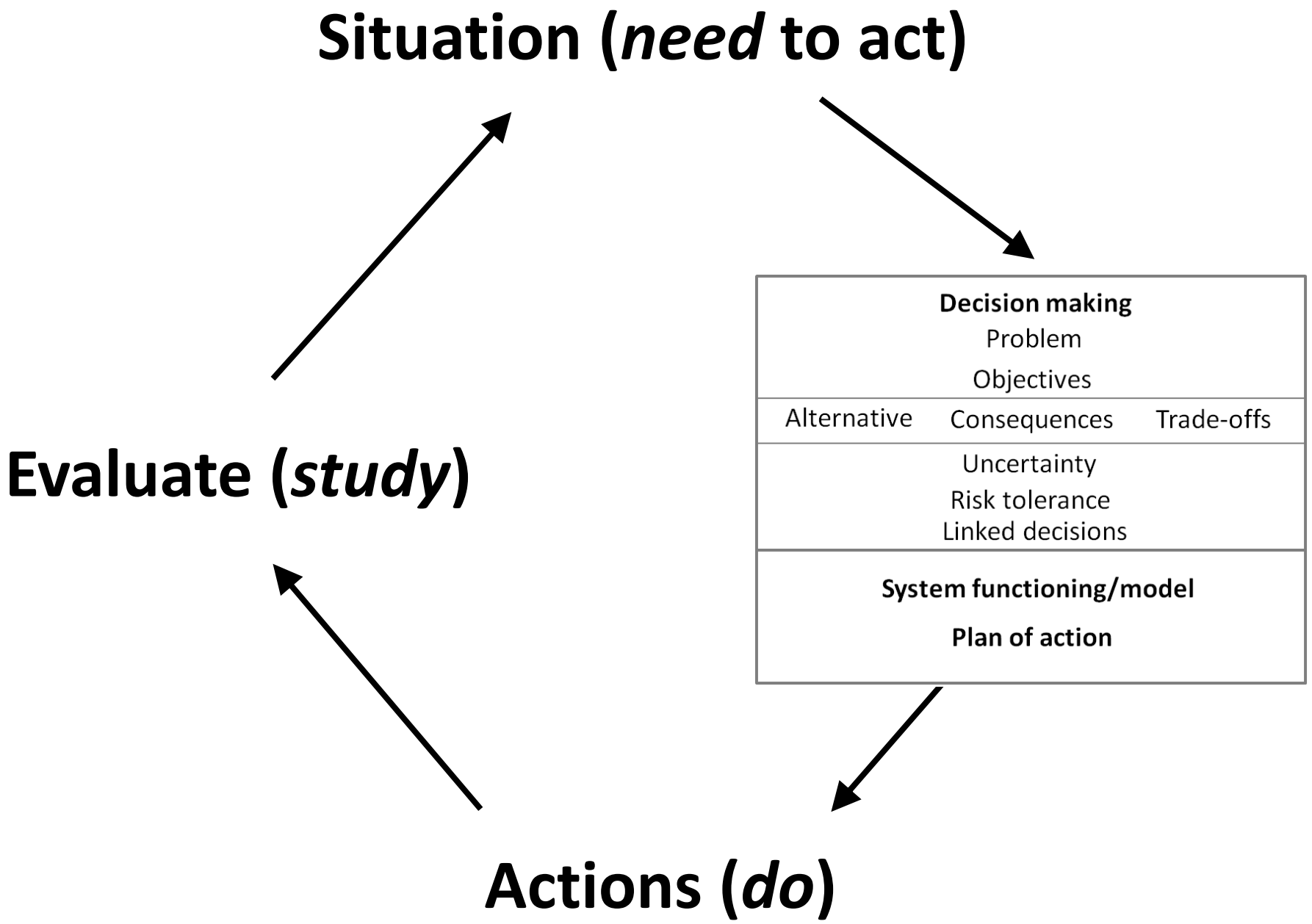
Healthy Systems?



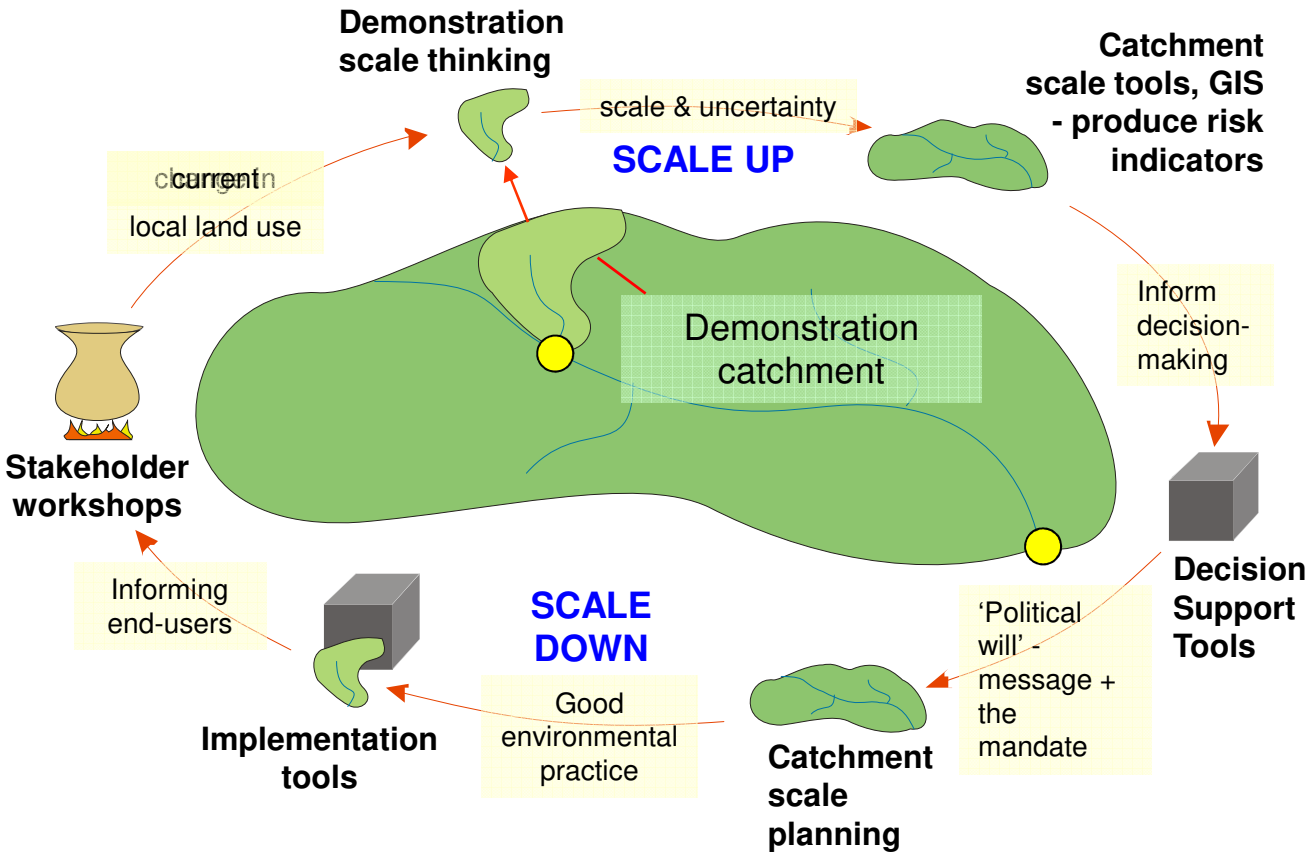
Problem solving- what is the vision?

Multi-scale issues

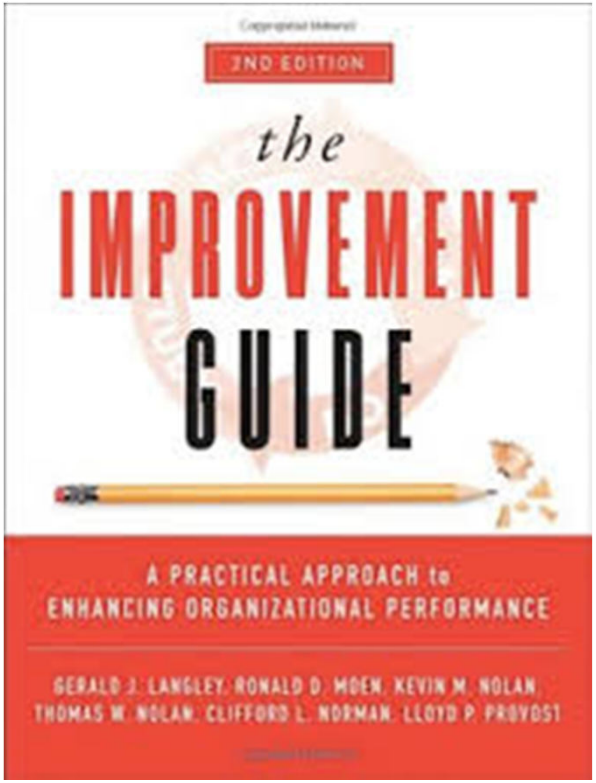



Situation (*need* to act)
Decision making
Problem
Objectives
Alternative
Consequences
Trade-offs
Uncertainty
Risk tolerance
Linked decisions
System functioning/model
Plan of action
Actions (*do*)
Evaluate (*study*)

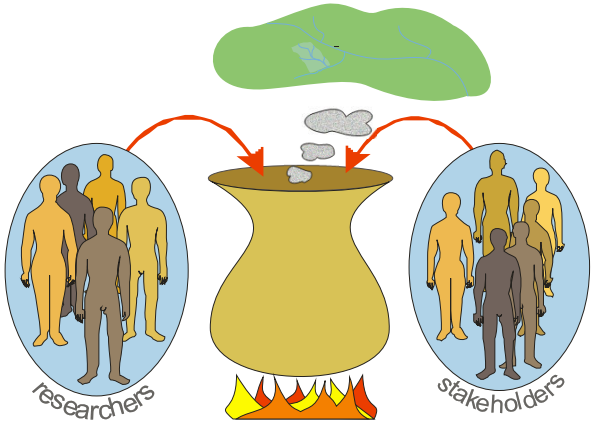
A Catchment Based Multi-Scale Framework

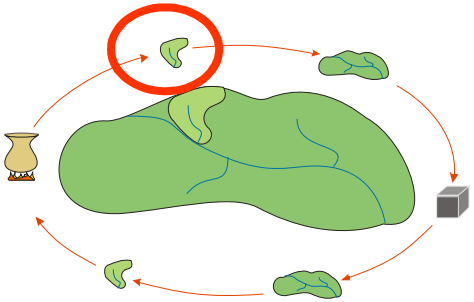


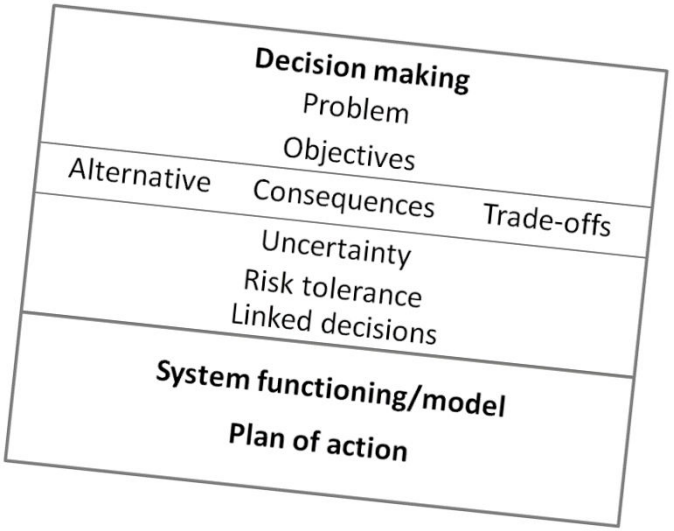

What are we trying to accomplish?
How will we know that a change is an improvement?
What changes can we make that will result in improvement?
Act
Plan
Study
Do


2ND EDITION
the
IMPROVEMENT
GUIDE
A PRACTICAL APPROACH to
ENHANCING ORGANIZATIONAL PERFORMANCE
GERALD J. LANGLEY, RONALD D. MOEN, KEVIN M. NOLAN,
THOMAS W. NOLAN, CLIFFORD L. NORMAN, LLOYD P. PROVOST

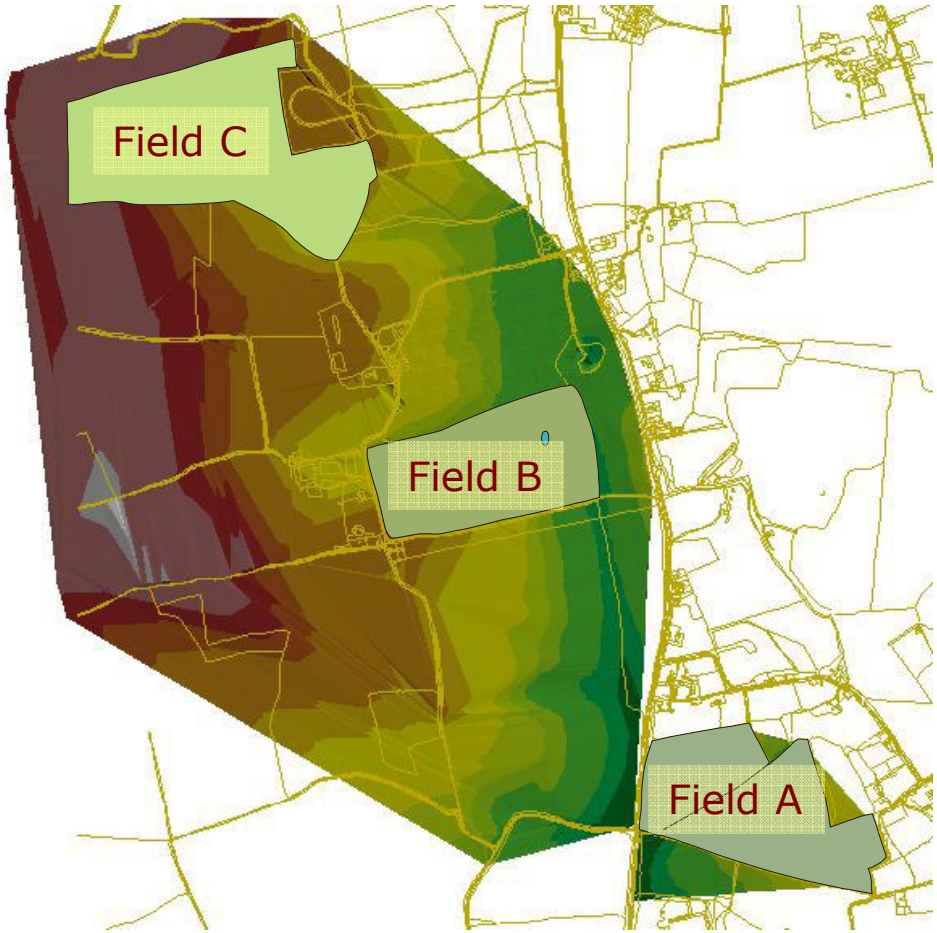
Local understanding, local knowledge and problem solving at a critical scale



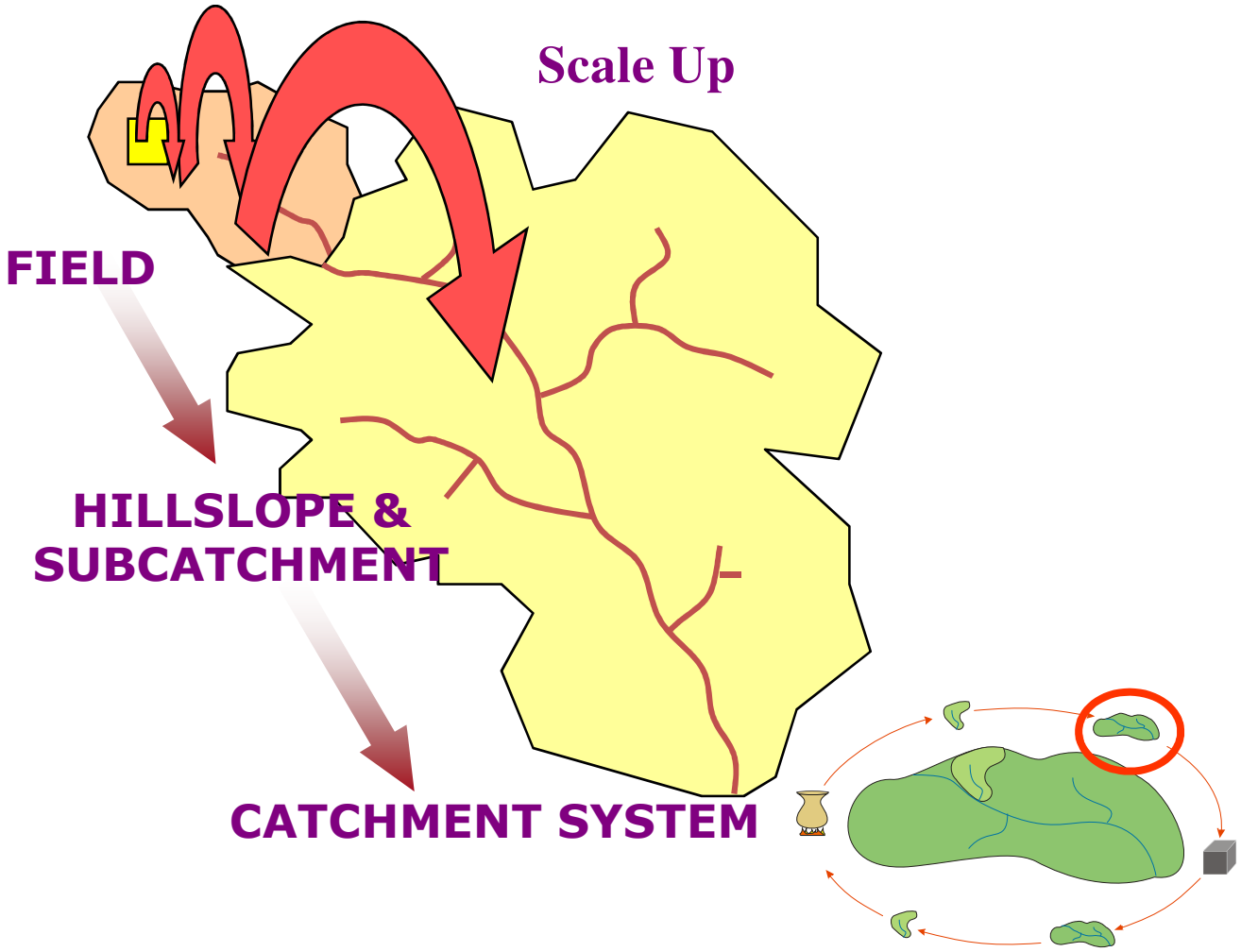




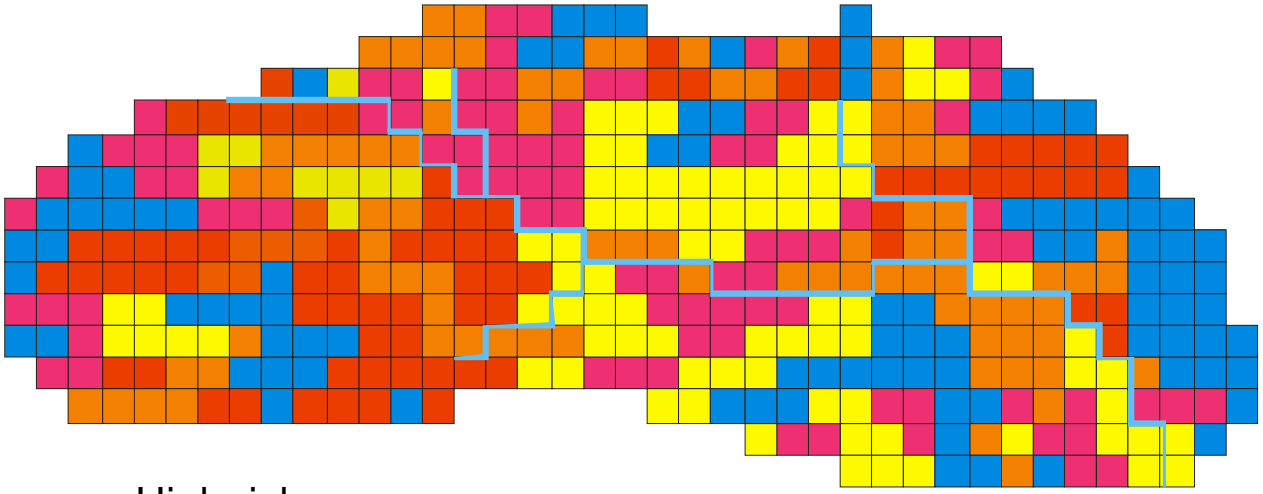
Demonstration Catchment - Human and Environment



The Bottom Up Approach



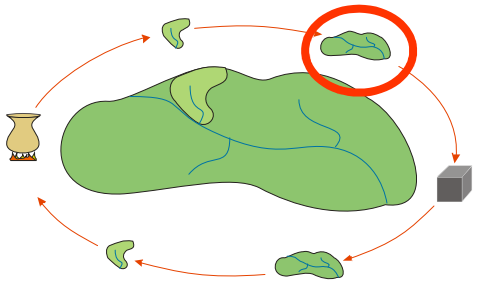
1km Risk Indicator Map – N.B. No Numbers Needed



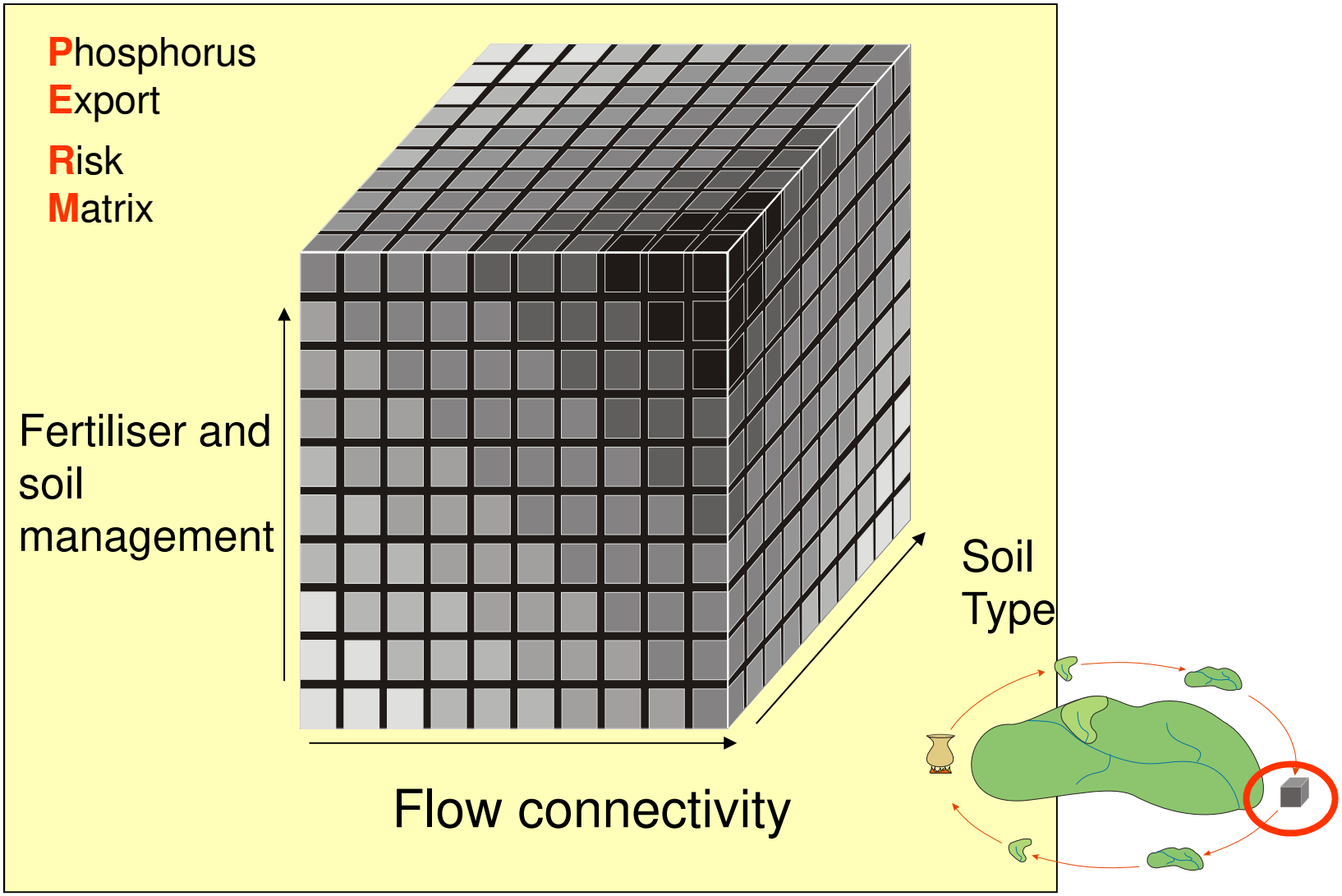
High risk

Medium risk

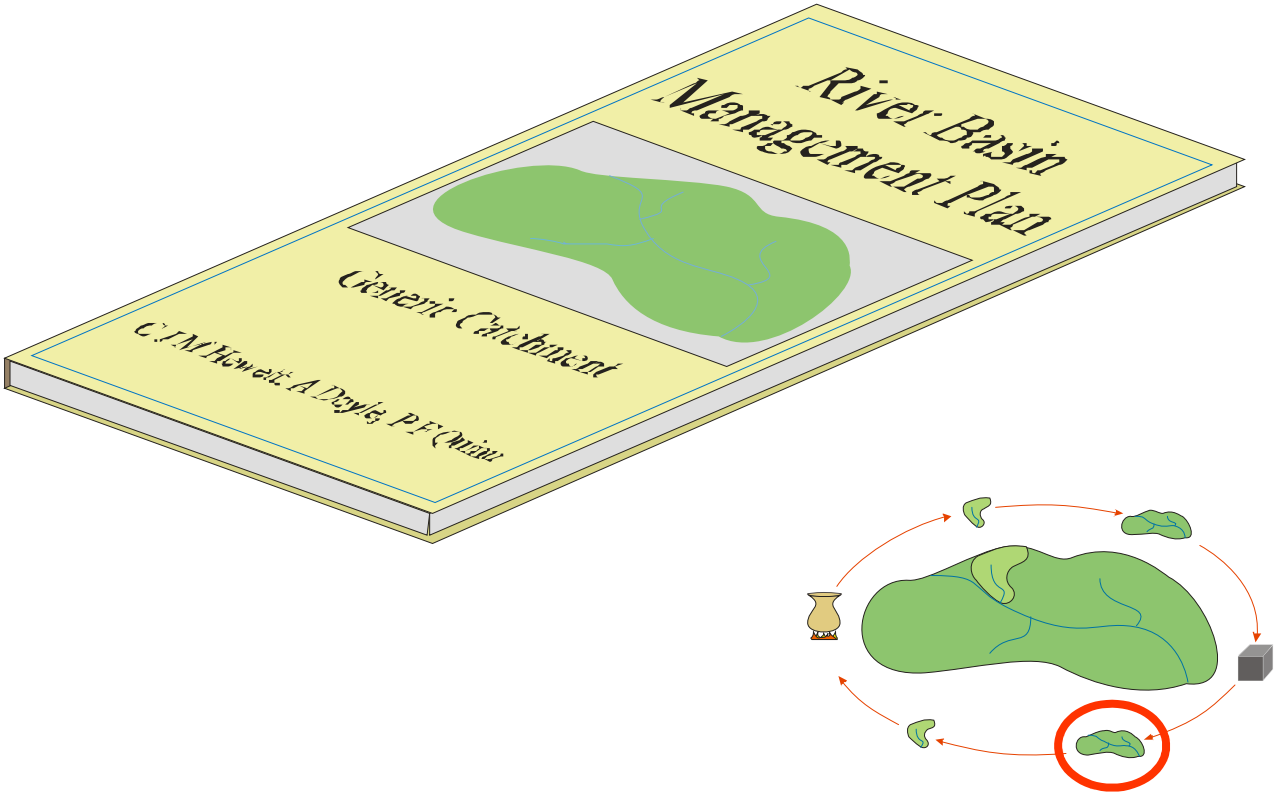
Low risk



Decision Support Matrix (DSM)



Policy / catchment planning



The vision

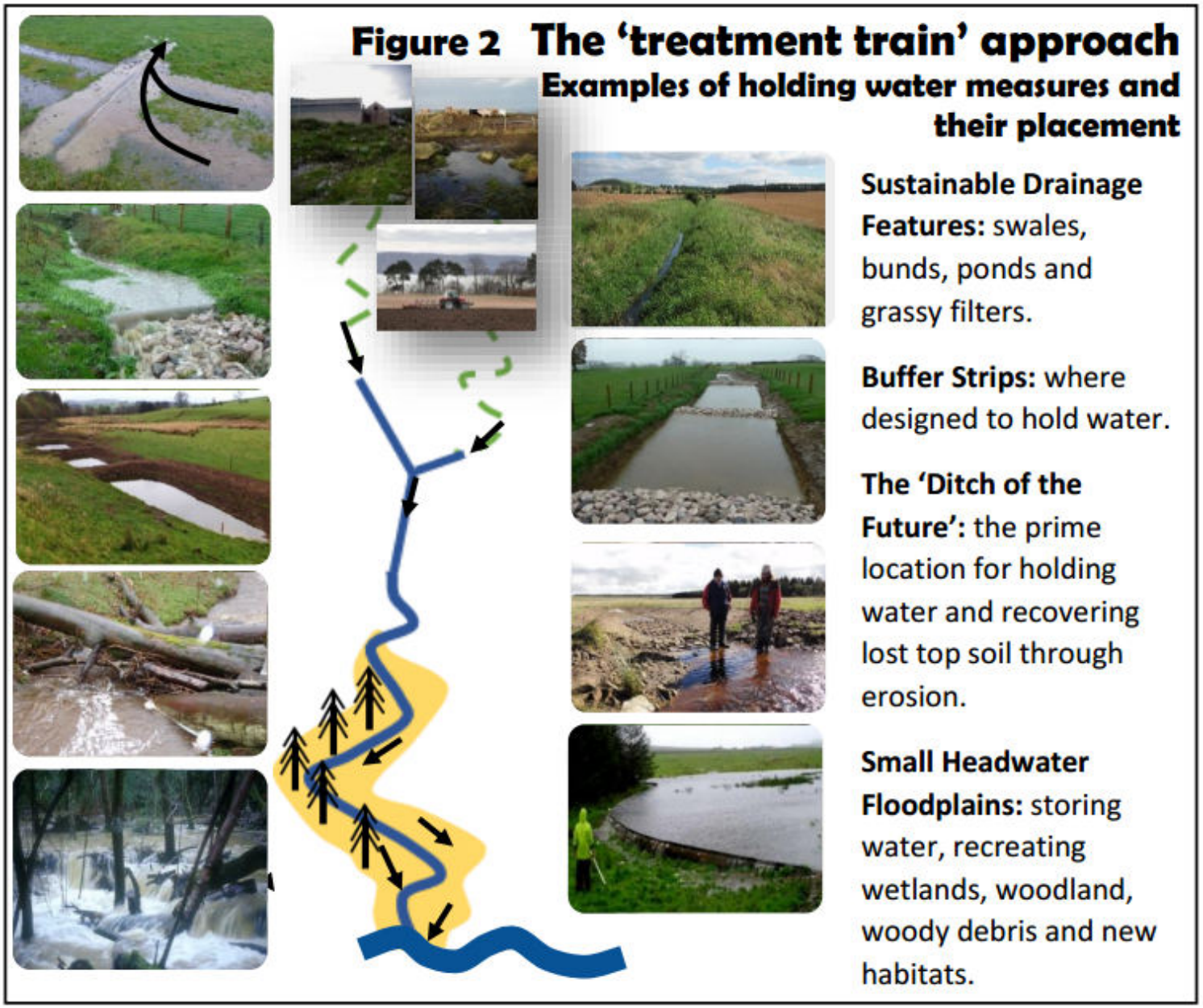
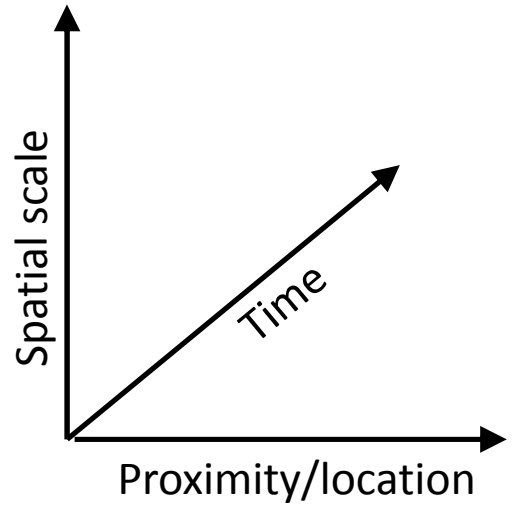


Figure 2 The 'treatment train' approach
Examples of holding water measures and their placement
Sustainable Drainage Features: swales, bunds, ponds and grassy filters.
Buffer Strips: where designed to hold water.
The 'Ditch of the Future': the prime location for holding water and recovering lost top soil through erosion.
Small Headwater Floodplains: storing water, recreating wetlands, woodland, woody debris and new habitats.

Field/feature – farm - water body - catchment

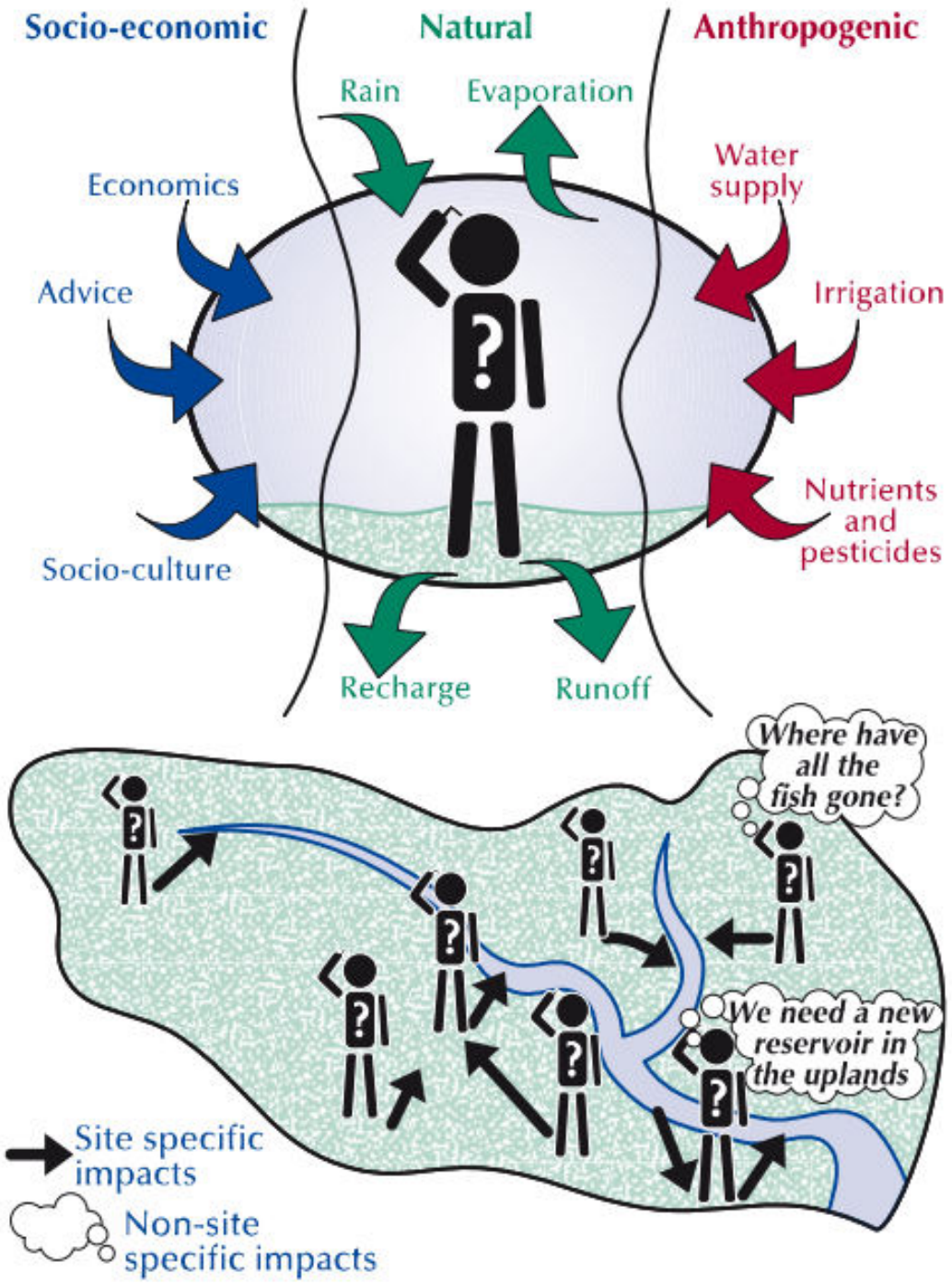
Linked decisions



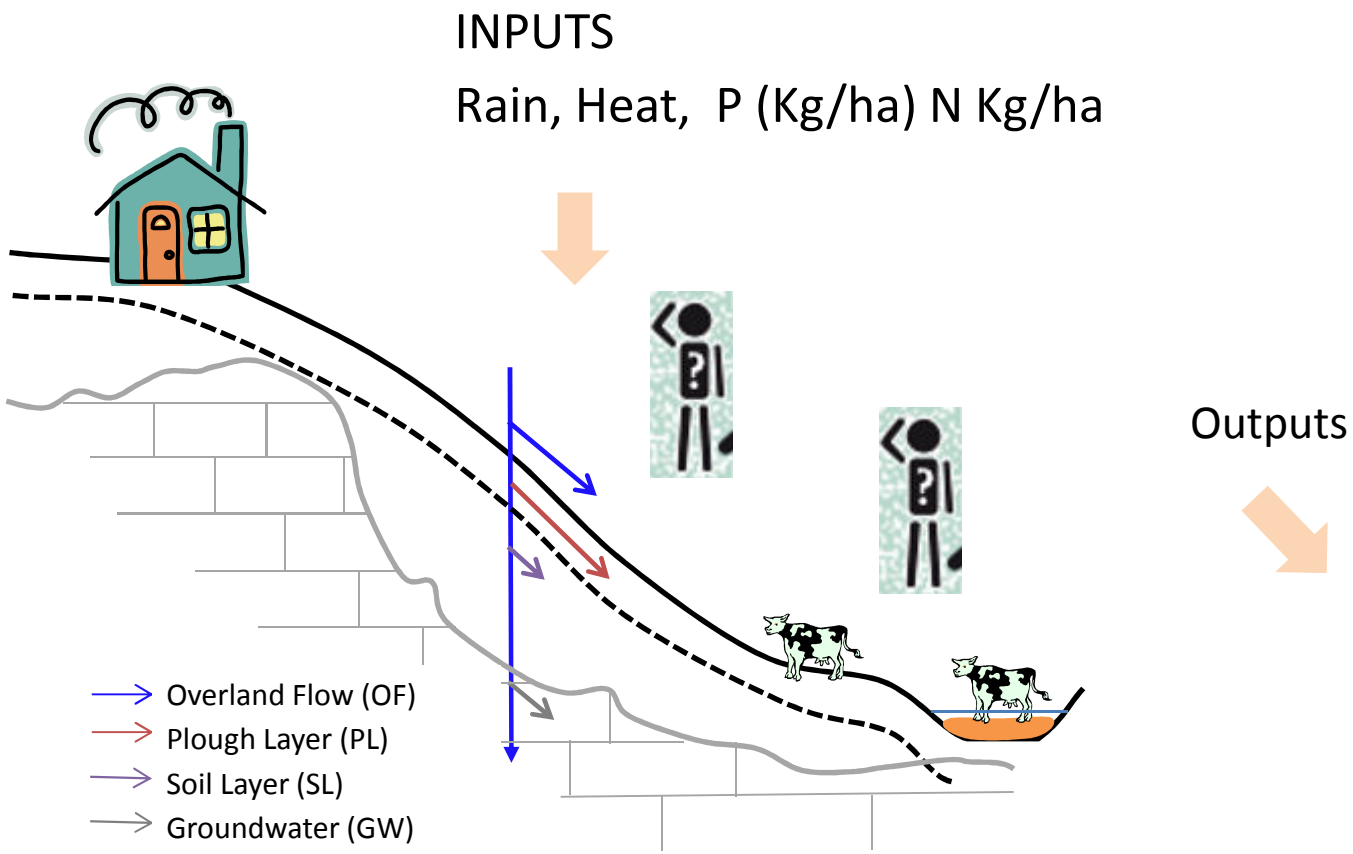
We need a fundamental building block for catchment systems

An appropriate level of skill and knowledge, leading to active intervention and learning in the landscape...

… That improves the management processes at that local scale … where benefits to the whole system will accrue


Socio-economic
Natural
Anthropogenic
Rain
Evaporation
Economics
Water supply
Advice
Irrigation
Nutrients and pesticides
Socio-culture
Recharge
Runoff
Where have all the fish gone?
We need a new reservoir in the uplands
Site specific impacts
Non-site specific impacts

Human-Environment Functioning Units



Conclusions

- Action Plan Evaluate -- Do Loops
- Space to learn and solve a real and interconnected problem
- A key scale where, knowledge, science, intervention and evidence of benefits are proven – confidence and trust is built

Key to this is

- The scale of study and action (2-20km^2)??
- Simple, effective representations of the Human-Environment Functioning Unit (HEFU)
- If HEFUs are healthy the catchment system becomes healthy