DSRRN Adaptive Management Workshop

January 9, 2013
University of Maine, Orono, ME

Program

- Morning session
  - ➢ *Lectures, Q&A on Adaptive Management*
    - what it is
    - how it should be done
    - deciding what to do
- Afternoon session
  - ➢ *Case studies*
    - three working groups
    - work through adaptive management problem framing

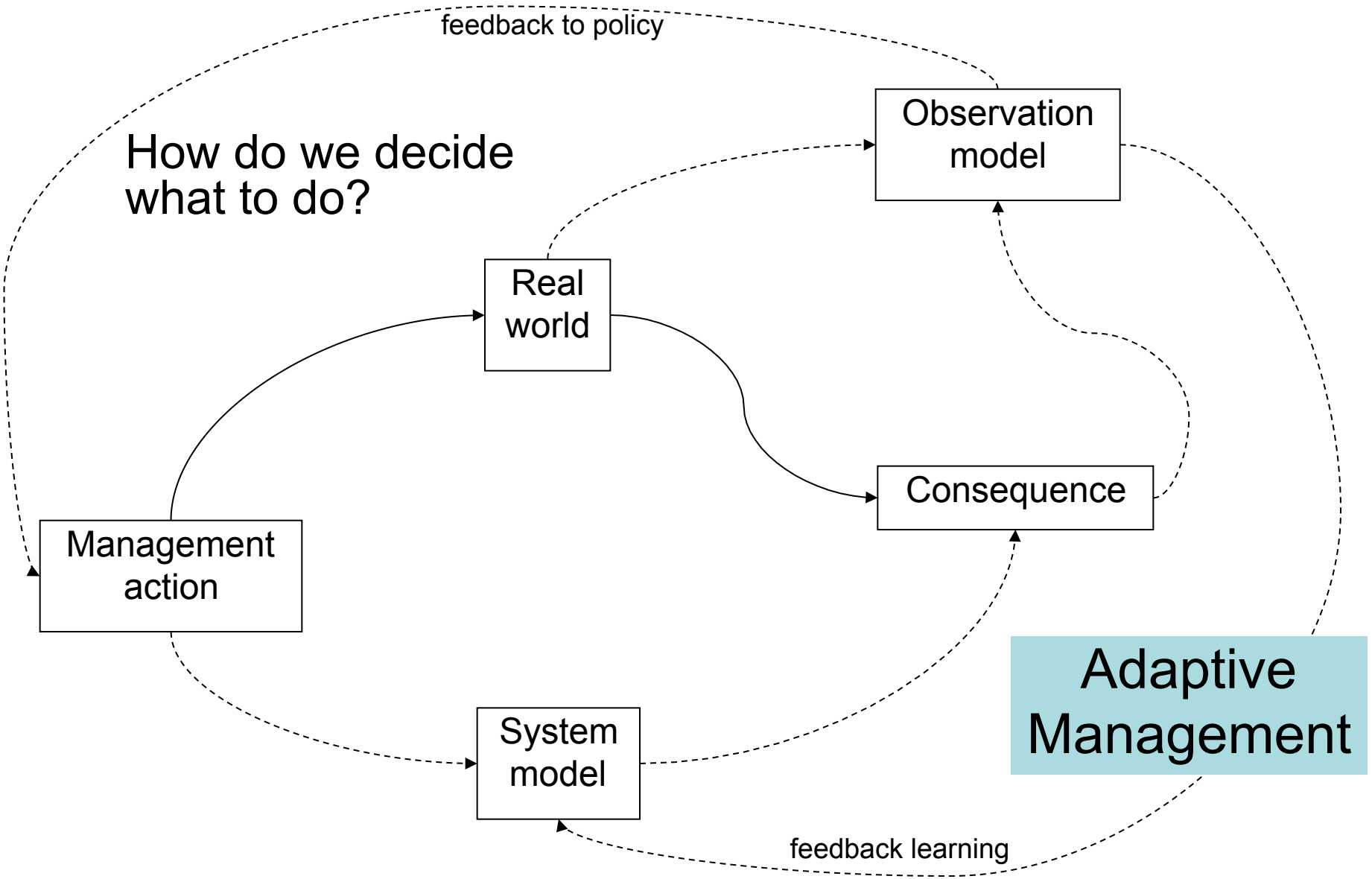
Instructors/facilitators

- Mike Jones
  - *Professor, Co-director, Quantitative Fisheries Center, Michigan State University*
    - Experience with AM as student, consultant, government scientist, and academic
- Elise Irwin
  - *Associate Professor, USGS – AL Cooperative Fish and Wildlife Research Unit, Auburn University*
- Mitch Eaton
  - *Assistant Professor, USGS – NY Cooperative Fish and Wildlife Research Unit, Cornell University*

Part 1: What is Adaptive Management?

- A simple model of management – how learning fits in
- Historical perspective – origins of Adaptive Management (AM)
- Defining AM
- The significance of uncertainty
- Key elements of effective AM
- The practice of AM – examples (time allowing)

A Simple Model of Management



Some History

- Environmental assessment in the 1970s
  - *Awareness of environmental issues*
  - *Systems Science discovers Environmental Science*
  - *Simulation models are the answer!*
- The “Ralph Yorque” group
  - *C.S. “Buzz” Holling, Carl Walters, et al.*
  - *Modeling does more to make us aware of what we don’t know (and its importance), than to help us use what we do know*
- The emergent question:
  - *Is learning an important ingredient of management?*

Carl Walters' argument

- Science, divorced from management, will not lead to (timely) answers
- Can't apply "conventional" science back to management scale
  - *Spatial/temporal scale wrong*
  - *Too many parts*
- In the meantime, management is conservative, clinging to current state of ignorance

The Dual Control Problem

- The choice that appears “best”, given our current state of uncertainty, may not be the choice that is best to make if you want to learn about the system.
- Maximizing expected benefits NOW and acting to reduce uncertainty IN THE FUTURE can be conflicting objectives
- Let’s look at an example:

Sockeye salmon in B.C.

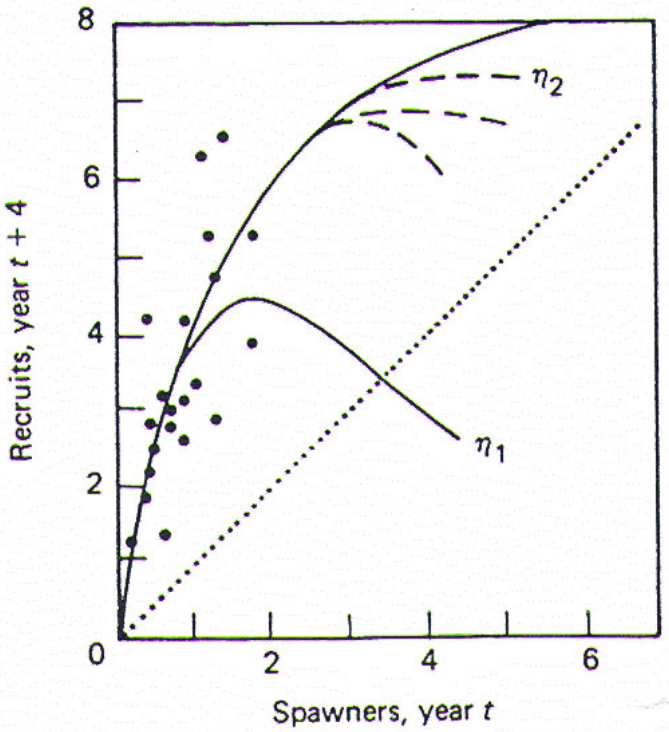
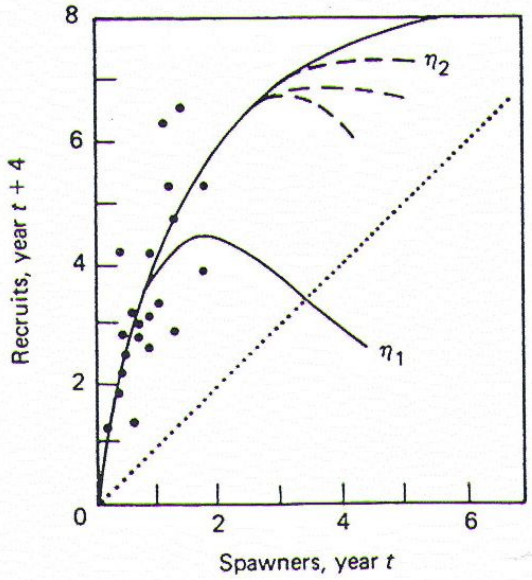
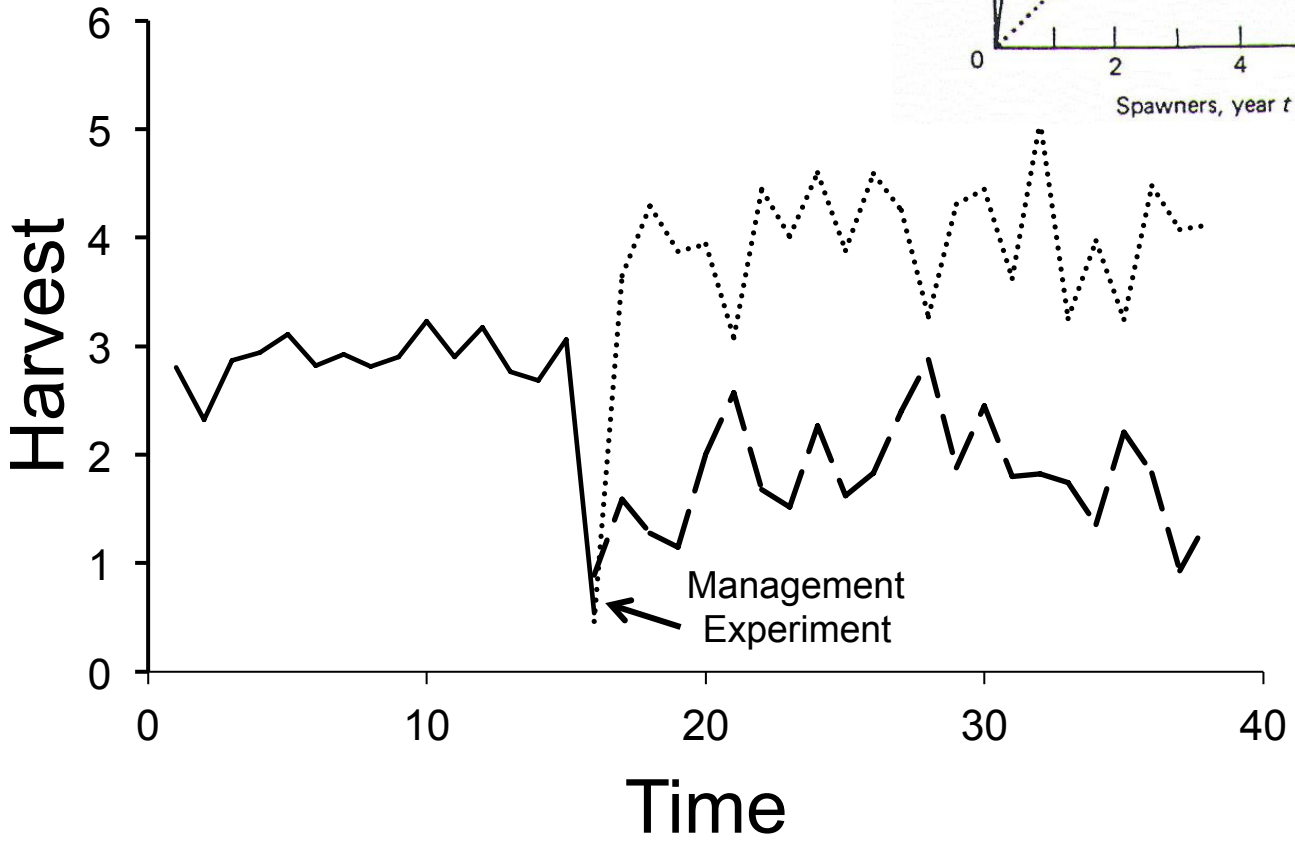


Figure 1.1. Relationship between number of sockeye salmon allowed to spawn in the Fraser River, BC, and the number of resulting offspring measured as recruits to the fishery four years later. Data are for 1939-73, omitting every fourth (cycle) year beginning in 1942. The curves η_1 and η_2 are alternative extrapolations of response to increased spawning stock. η_2 predicts higher yields if more fish were allowed to spawn. *Source:* Walters and Hilborn (1976); see also Walters (1977), Holling (1978).

Sockeye Salmon AM





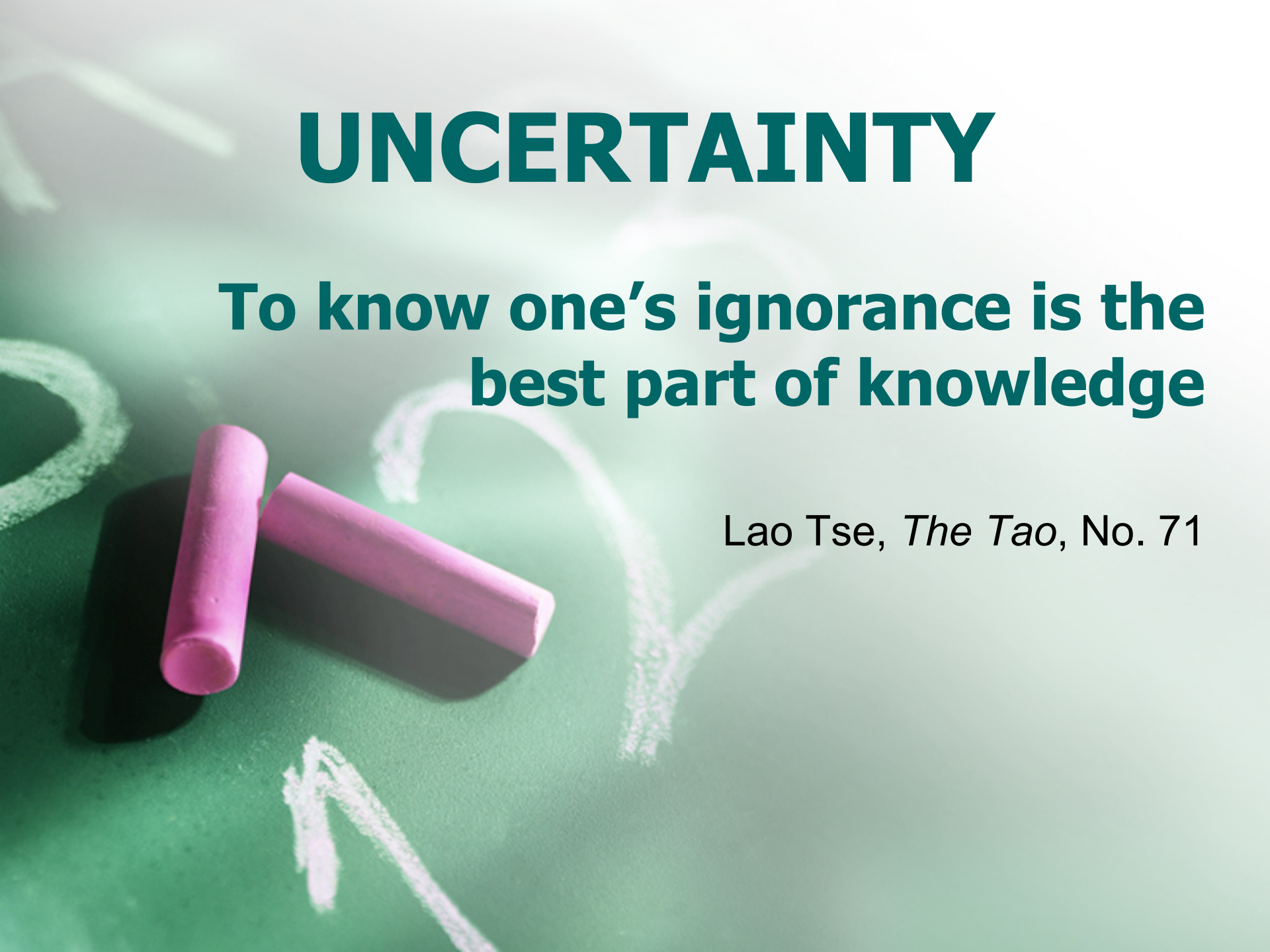
Adaptive Management:
a simple definition

Adaptive management is:

- *Learning by doing – using the management process itself as an opportunity to learn*
- *Adjusting management decisions in the future, according to what you learned*

Active versus passive AM

- All AM involves testing hypotheses
- Passive AM means avoiding the dual control problem
  - *Conduct management according to best current knowledge*
  - *Update "models" as the outcome of management is observed*
- Active AM means confronting the dual control problem
  - *Designing management experiments that risk short-term benefits for increased learning*



UNCERTAINTY

To know one's ignorance is the best part of knowledge

Lao Tse, *The Tao*, No. 71

Types of Uncertainty
(after Williams 1997)

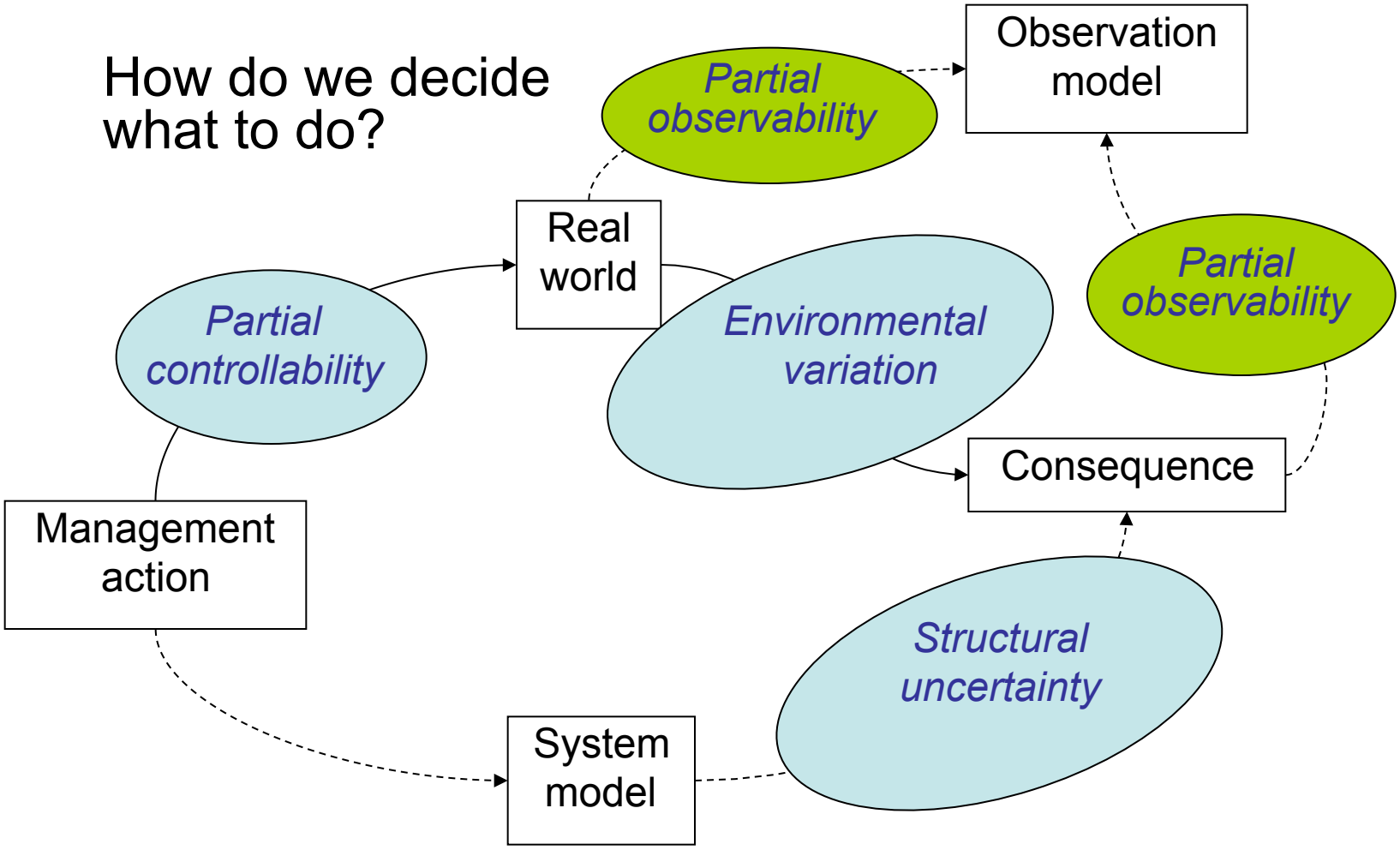
- Environmental variation
- Structural uncertainty
- Partial observability
- Partial controllability

ALSO:

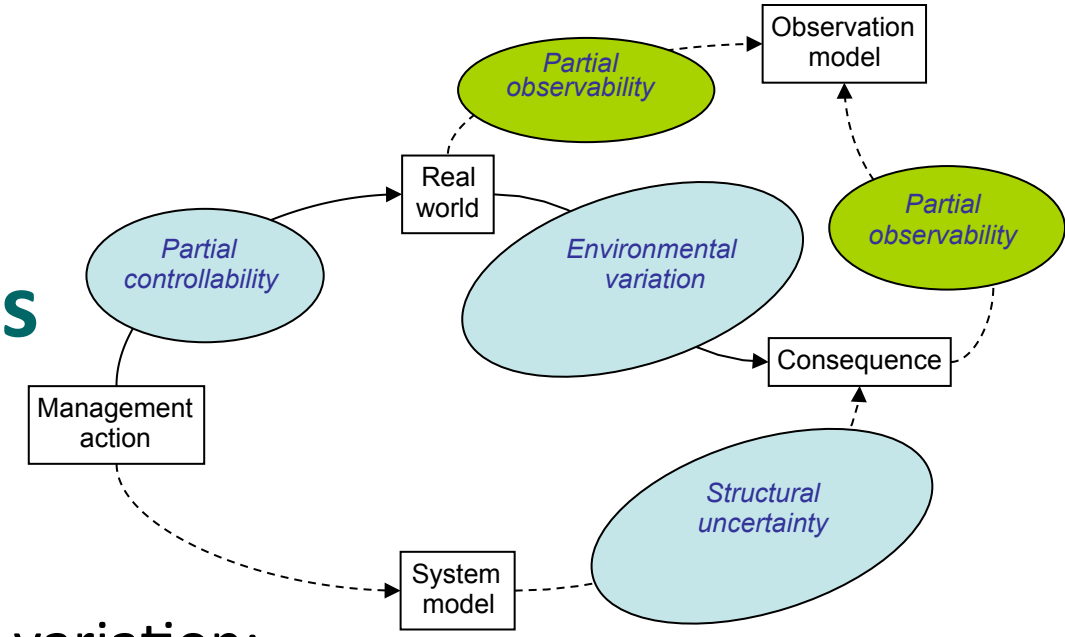
- Linguistic imprecision

Williams, B.K. 1997. Wildlife Society Bulletin 25:714-720

Uncertainty and the Management Process



Related terms



- Environmental variation:
  - *Natural variation, Process error*
- Structural uncertainty:
  - *Model uncertainty, Parameter uncertainty*
- Partial observability:
  - *Observation error, Measurement error*
- Partial controllability
  - *Implementation error, Outcome uncertainty*

Key features of adaptive management

- Decision choices exist and can be articulated
- Stakeholders are involved
- Management objectives are defined and agreed upon
- Key uncertainties are specified, and known to matter for decisions
- A model is developed that predicts outcomes, given alternative hypotheses
- Monitoring occurs:
  - *Relevant to hypotheses*
  - *Relevant to objectives*
- Management can adapt to outcomes, iteratively

Features of good (management) experiments

- Contrast
- Replication
- Randomization
- Interspersion
- Observability

Each of these features is usually “expensive”.

"Famous" Examples

- Migratory waterfowl
  - *Williams, B.K. et al. 1995. J. Wildlife Management 60:223-232.*
  - *Williams, B.K. and F.A. Johnson. 1995. Wildlife Society Bulletin 23: 430-436.*
- Glen Canyon
  - *Brouwer, G. 2002. Civil Engineering 72(8): 24-25.*
  - *Meretsky, V.J et al. 2000. Environmental Management 25: 579-586*
- Australian trawl fisheries
  - *Sainsbury, K.J. et al. 1997. In: Global Trends: Fisheries Management. E.L. Pikitch, D.D. Huppert, and M.P. Sissenwine, eds. pp107-112*

Some key AM references

Holling, C.S. 1978. Adaptive Environmental Assessment and Management. Wiley, Chichester, UK. 364 pp.

Walters, C.J. 1986. Adaptive Management of Renewable Resources. MacMillan, NY. 374 pp.

Lee, K. 1993. Compass and gyroscope: integrating science and politics for the environment. Island Press, Washington

Williams, B.K. et al. 2009. Adaptive Management Technical Guide. US DOI, Washington.

http://www.doi.gov/initiatives/AdaptiveManagement/documents.html