

## What are models?

A model is a way of representing nature that should act like or describe processes and states in a controlled and simplified way to answer questions...

They can, for example, be:

- Conceptual
- Based on experience
- Mathematical
- Stochastic
- Quantitative/semi-/non-quantitative
- Descriptive tools
- Predictive tools

Types include:

- Statistical
- Probability
- Mechanistic
- Descriptive
- Simulation
- Artificial Intelligence

In this case they are NOT scale models/physical models

## Why, When and How do we use models?

WHY do we use models:

- To simplify natural processes
- To predict the future without having to wait for it to happen...
- To quantify relationships/change
- To make money
- To save money
- To assess inter-relationships/impacts/problems
- To inform and convince
- To gain insight/understanding of nature and change
- To provide a scientific basis for management and decision making (DSS)
- To validate ideas/other models
- To manage natural resource use
- To reduce/resolve conflict
- To develop mitigation strategies
- To support awareness and gain common understanding

WHEN do we use models:

- When we cannot understand a problem by direct observation and we need to know what will happen in the future...
- When we need to assess different options
- When we need to review information
- When we have limited resources (funds etc.)
- When we want to understand complex relationships
- Because we can...

HOW do (or should) we use models:

We tend to use a hierarchical approach...

In combination with data collection to calibrate/validate

Carefully...

## **Uncertainty**

Why do we need to measure uncertainty?

Because we need to know how reliable a result will be to make decisions wisely.

To account for natural variability in systems

To evaluate risk

### **How can we include uncertainty in the outputs?**

By knowing the uncertainty in the inputs

By evaluating simulations against measured data

By expressing variables in the correct way

By using different simulation parameters/options and scenarios

By calculation of standard errors

Benchmarking (international standards)

### **How can we communicate uncertainty?**

The models have to have acceptable levels of uncertainty before you communicate the outputs...

Use probabilistic measures?

Show confidence intervals?