*** Adaptation Training Initiative ***

weADAPT

Uncertainty and complexity

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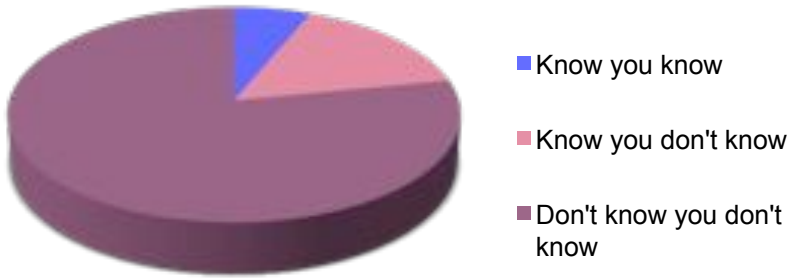
Uncertainty

Uncertainty is "unknowable information", it can arise from lack of knowledge, lack of data, or a limited understanding.

Three types of knowledge (Brewer 2005), i.e. "known knowns":

1. Things we know we know
2. Things we know we do not know - uncertainty
3. Things we do not know we do not know – deeper uncertainty, ignorance, surprise



Uncertainty is part of all climate-related science: limited understanding of the climate system, feedbacks, micro-climates, different emission scenarios, multiple future climate scenarios and non probabilistic approach.

Single event (crossing threshold, tipping points), recurrent events (return period of a flood), discrete event (hurricane frequency), complex events (interplay of different factors that lead to drought).

Uncertainty

- Recognising and working with **inherent** complexity and uncertainty
- Understanding dimensions of **differential** and dynamic vulnerability including **multiple stressors**

✓ Uncertainty inherent in predictions of future climate change and the complexity of dynamic socio-economic systems require a **faster and more responsive coping** and adaptation cycle than in the past.

✓ This uncertainty and complexity also implies that **new vulnerabilities** and **surprise** may emerge which further complicate the ability to plan for successful transitions to a sustainable and resilient management regime.

✓ That is, managing these inevitable uncertainties requires improved **learning** mechanisms to be incorporated in our planning

Dynamic vulnerability and complexity

- ✓ A key barrier to facilitating successful transitions is **path dependence** which is the result of investments in previous technologies and practices resulting in ‘lock-in’ effects, even if the current pathway is unsustainable (ibid.).

- ✓ Attempt to break or avoid 'lock-in' effects which inhibit innovation and experimentation when dealing with uncertainty.

- ✓ Identification of the **factors that contribute to vulnerability** and how this **changes** over time and at different scales, to allow the identification of learning and adaptation mechanisms that have both worked and failed.

Dynamic vulnerability and complexity

1. **Differential** social and economic vulnerability.

   a.) the differential exposure to stresses experienced or anticipated by **different exposure units**;

   b.) vulnerability is composed of **multiple stresses** which are inherent in the integrated vulnerability of peoples, places and systems.

2. The **dynamic** element of vulnerable groups and their relationship to the natural resource base.

   dynamic processes, which are constructed and change simultaneously on a variety of **inter-linked time and spatial scales**;

Dynamic vulnerability and complexity

3. Ability to respond (adaptive capacity) is:

    a.) rooted in the actions and multiple attributes of human actors;

    b.) driven and bound by social networks in social, economic, political and environmental interactions;

Vulnerability as a dynamic process

Two processes relate to vulnerability:

(a) trends of gradual change (though not necessarily linear) vary within predictable limits, generally at a macro scale and

(b) shocks that are sudden and dramatic impact and can fundamentally alter more than one condition of life.

The superimposition of trends and shocks may dramatically alter socio-economic conditions at the **macro** scale (e.g., the Asian tsunami or New Orleans hurricane) or the often hidden catastrophes at a **micro** level (such as the sudden death of a key breadwinner in a family or the erosion of one's land and home in a flood). This is the dynamic nature of vulnerability (Downing et al., 2006: 6).

Uncertainty

- Limits to our ability to model complex and emergent systems?
- ‘Unknown unknowns’, or surprises in the system: we know it is non-linear and has changed rapidly before.
- Over-confidence in precise predictions might lead to maladaptation: e.g. hydropower expansion based on a ‘wet’ projection.

Socio-economic uncertainty

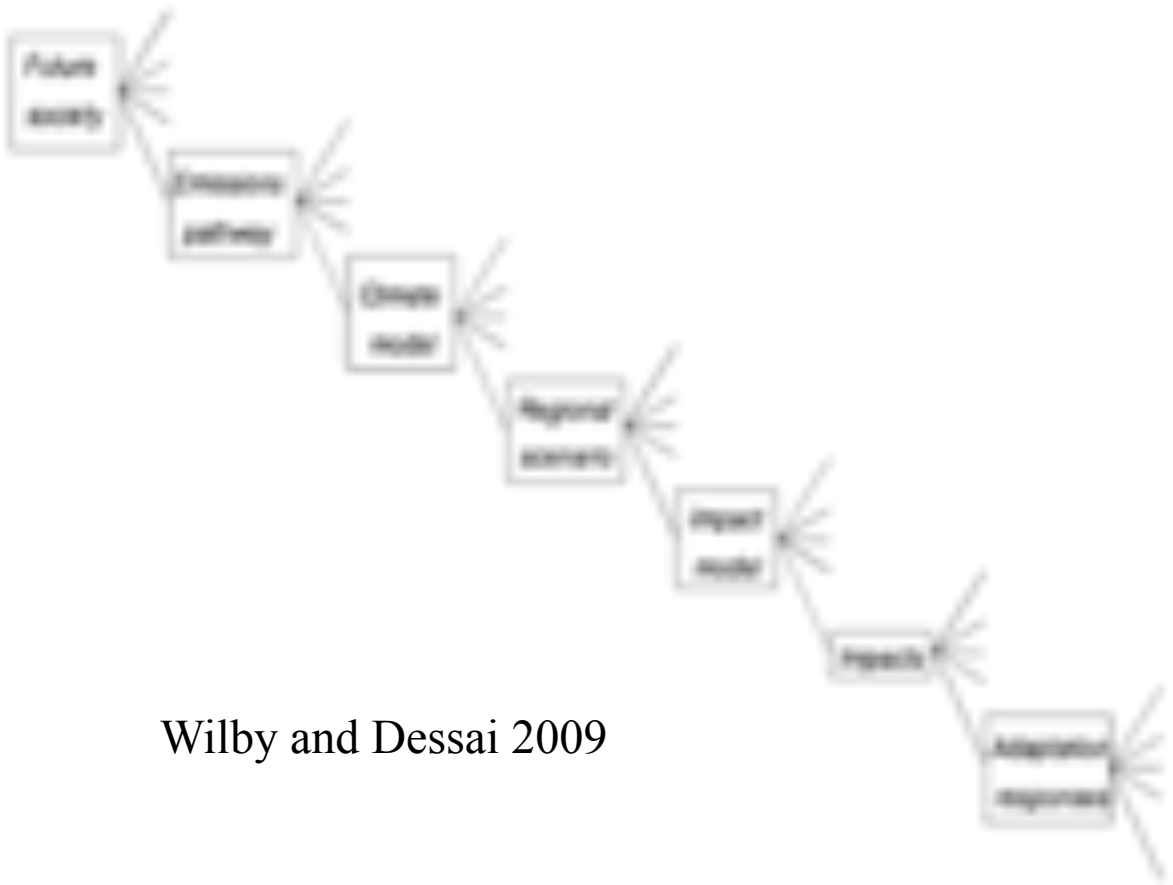
The trouble with predicting society. . .

- ‘You will think nothing of taking a fortnight’s holiday in space’
- ‘Rocket belts will increase a man’s stride to 30ft’
- ‘It will be a crime to burn raw coal and pollute the skies with soot and smoke’
- ‘Growth of amputated limbs will be possible’

More recently. . .

- The inventors of mobile phones didn't think text messaging would be popular
- How many clever people missed the signs of an impending economic crisis?
- Tim Berners Lee had an idea of the power of the internet - but couldn't have imagined its potential for change.
- From 2006-2007 mobile phone use almost doubled in Thailand

Cascading Uncertainty



Wilby and Dessai 2009

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How do I deal with uncertainty?

- In reality we are used to taking decisions without accurate predictions (Dessai et al).
- Options that are less dependent on one scenario or another – more resilient.
- Not necessarily the optimal/best strategy for any 1 scenario, but the most sustainable.
- Don't close doors – be flexible (e.g. leave space for extra flood management).

How do I deal with uncertainty?

- Create a plausible list of adaptation strategies.
- Create a list of plausible scenarios of the future (firstly climatic then socio-economic).
- Think how your strategies would likely perform in each scenario of the future.
- Look for those that are little affected by the range of uncertainties. . .
- Seek robust (‘good enough’), not optimal, strategies and work with the best available information

How do I make ‘robust’ decisions?

Achieve robustness with adaptive planning (i.e. iterative process) – act, learn, act again.

Allow for flexibilities in decision making strategies against multiple future possibilities and avoid ‘lock-in’ strategies

Adaptive planning involves a decision-pathway approach that:

Is flexible to unknown future states

Does not assume high ability to predict future risks or decision outcomes

Has series of decision nodes / small plans over time to allow for iterative process as new information becomes available

"Adaptive management is learning to manage by managing to learn" (Bormann et al, 1993)

Managing to learn from:

- The past
- Present similar actions
- Other people doing similar things
- Stakeholders who will be affected by (lack of) changes

Processes in adaptive management

Decision making processes

- open to information from diverse sources
- allow for changes in rules and structures
- exchange information and work across spatial scales and sectors

- Taking a more holistic view to the management of socio-ecological systems
- Risk communication and social learning should be supported to inform decision-making at range of scales

Adaptive Capacity

- We are trying to increase ability to cope with change
- Increasing our options and the ability to implement these options
- Complicated, but access to resources, decision-making processes, information, social networks all play a part
- Key: the ability to be flexible and to monitor the situation and respond to new information as it becomes available

"It would appear, Hopkins, that your gut feel was only indigestion"

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