State of the art in valuation of damage to ecosystem services

Mike Holland, mike.holland@emrc.co.uk

Objectives

- How we have improved

‘Damage to ecosystem services’

- Not the value of the full service
- The value of change in the service

- A number of the problems faced are common to assessment of both, but not all

The usefulness of the ecosystem services approach

- Attaches value where nothing was previously given
- Develops understanding of why we value ecosystems – associated complexity
- Challenges assumptions
  - Greenbelt vs brownfield development?

Early valuation studies

- Value of species
- Value of preventing acid rain
- Surprising results

There is good news

- Substantial refinement of valuation methods
- Emerging examples of quantifying and monetising change rather than stock
- Increased attention to ecological indices
  - Linking available ecological tools to valuation

Questions remain

- How well do we understand aggregation
- WTP for what, precisely?
  - Air quality
  - Climate change
  - Chemicals
- Trade-offs?
- Scale of change?
- Human response?
- Timing of effects?

‘Damage to ecosystem services’

- Demand for response functions
  - For effects of air pollutants (and other stresses)

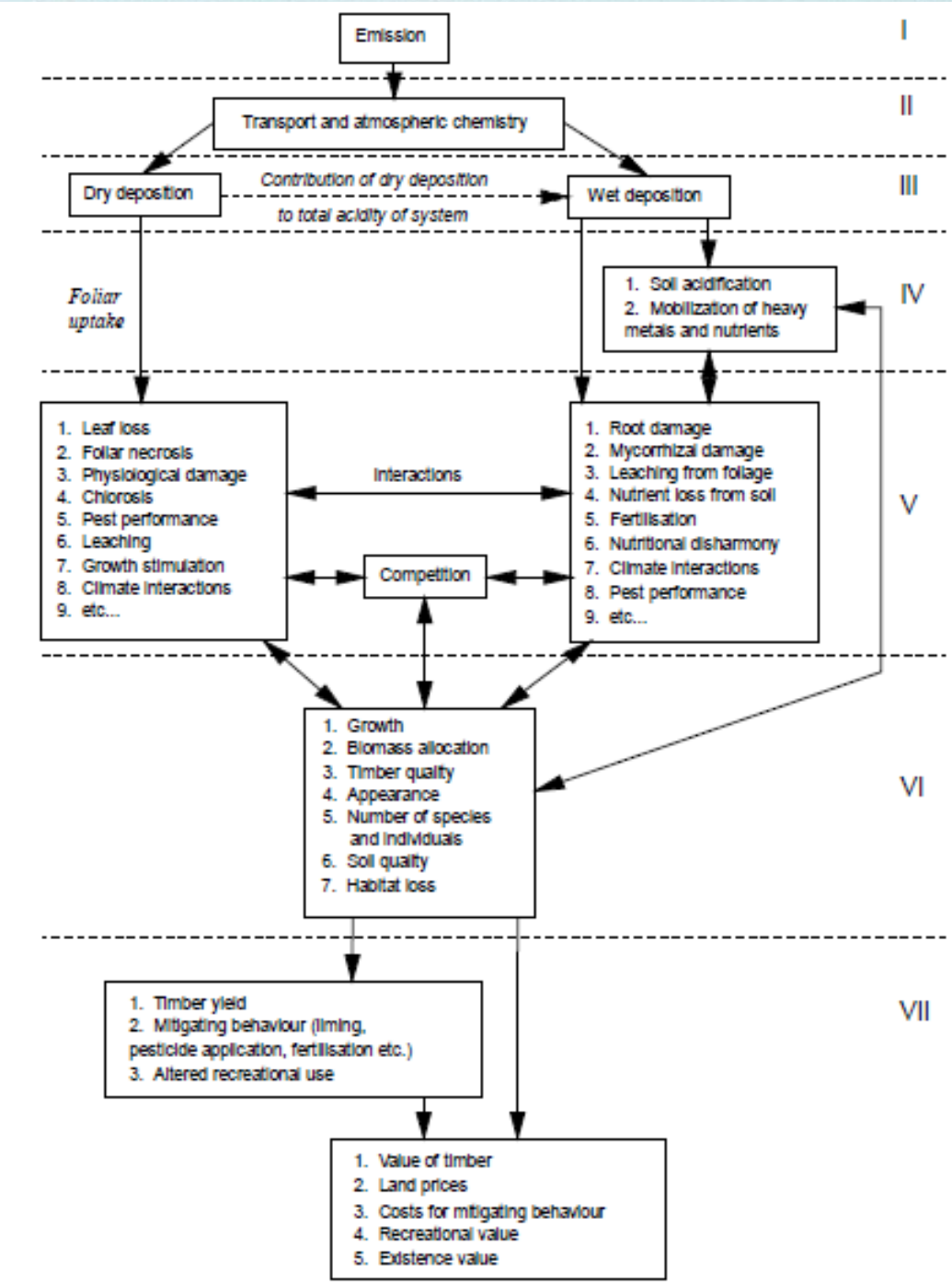
  And also…

  - For response of authorities, managers, etc. to change

Complexity of systems

Example:

Effects of acidic deposition on forests



Complexity of describing response and its consequences

- Damage: Lost timber production
- Forest manager reaction (possibilities)
  - Maintain harvest schedule
  - Shorten rotation times
  - Plant more trees
  - Plant different trees
- Background demand
  - Reduced demand for paper
  - Increased demand for biofuel

Complexity of response

- Effect of baseline condition
  - N deposition and fertilisation benefit in agriculture
  - But is N limiting in agriculture given farmers' actions
    - Yes, but not everywhere

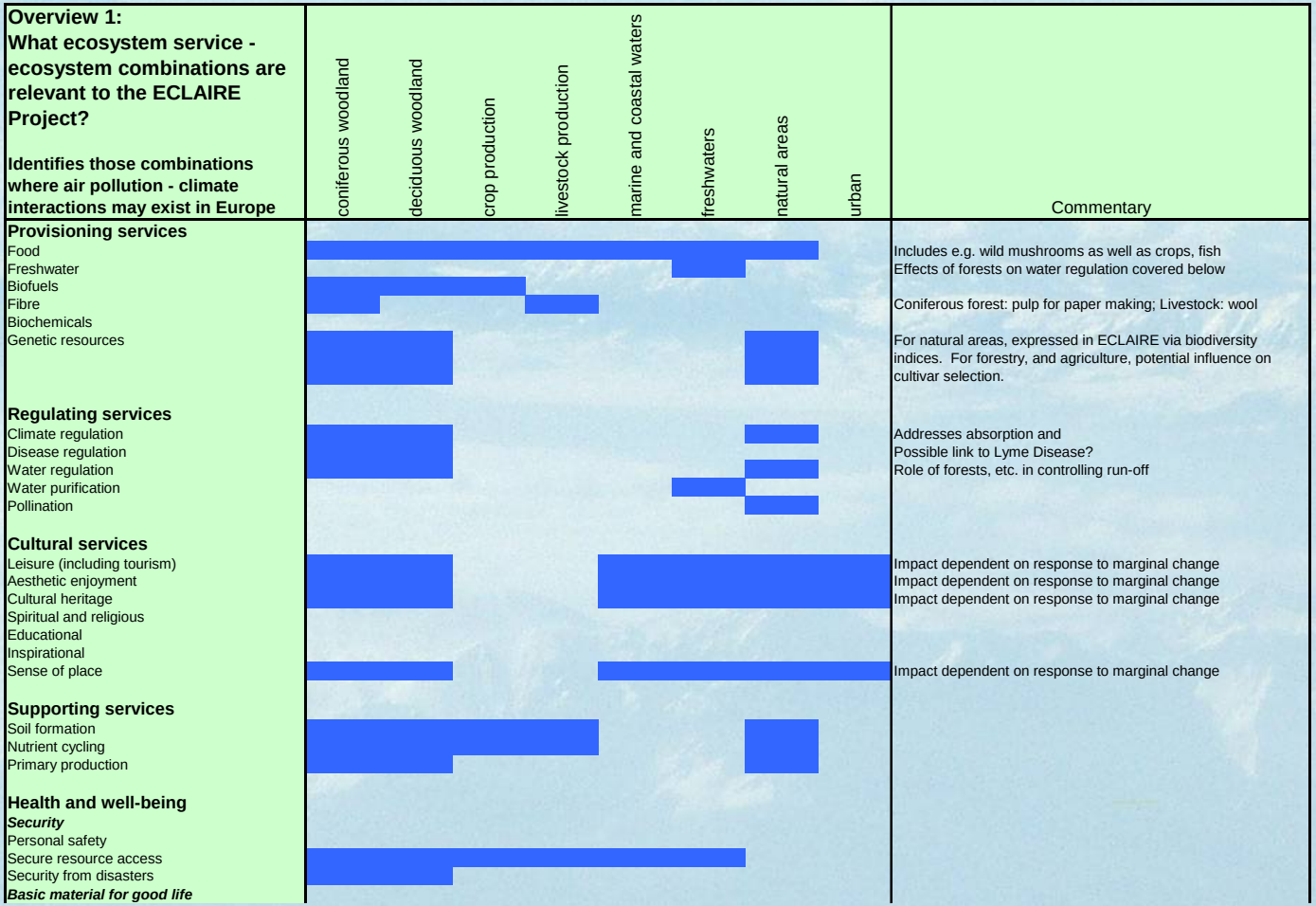
Framing/boundary assumptions

- Valuing GHG releases
- What are the system constraints?
- Emission ceilings
  - What is the effect of a change in emission?
  - If less, someone else can emit more
  - And vice-versa
  - No change in damage
  - But a change in the cost of meeting the ceiling

Roadmap

- Define the problem
  - Agents
  - Linkages
  - Affected services
- Understand available data
  - E.g. what do the indices mean?
  - How would people respond?

Structuring the analysis



Where should priorities lie?

Overview 2: What ecosystem service - ecosystem combinations should be prioritised in the ECLAIRE Project?	coniferous woodland	deciduous woodland	crop production	livestock production	marine and coastal waters	freshwaters	natural areas	urban	Commentary
Provisioning services									
Food									Lack of data on wild food production. Impacts likely dominated by agriculture
Freshwater									Outside scope of ECLAIRE
Biofuels									
Fibre									Coniferous forest: pulp for paper making; Livestock: wool
Biochemicals									
Genetic resources									Expressed in ECLAIRE via biodiversity indices for natural areas. For forestry and agriculture there may be effects on cultivar selection.
Regulating services									
Climate regulation									Quantification using marginal costs of GHG abatement
Disease regulation									Outside scope of ECLAIRE
Water regulation									Outside scope of ECLAIRE
Water purification									Outside scope of ECLAIRE
Pollination									[Further research needed]
Cultural services									
Leisure (including tourism)									Impact likely to be inseparable from 'cultural heritage'
Aesthetic enjoyment									Impact likely to be inseparable from 'cultural heritage'
Cultural heritage									Limited number of useful valuation studies. Those available are likely to cover several 'cultural services'
Spiritual and religious									
Educational									
Inspirational									
Sense of place									Impact likely to be inseparable from 'cultural heritage'
Supporting services									
Soil formation									[Further research needed]
Nutrient cycling									[Further research needed]
Primary production									[Further research needed]
Health and well-being									
Security									
Personal safety									
Secure resource access									Outside scope of ECLAIRE
Security from disasters									Outside scope of ECLAIRE
Basic material for good life									

Providing an overview

Crop production				
Effect	**Direct effects of ozone on crop yield through impairment of photosynthesis**	**Direct effects of nitrogen on crop yield through fertilisation**	**Ozone damage, e.g. inury to leaves, making crops unsaleable**	**Quality of food**
What is affected?	Wide range of crops	Potentially all crops, though impact will be a function of agricultural management practices	Crops such as lettuce and other salad crops, for which the appearance of leaves determines saleability	To be confirmed
Stock at risk data	Maps of crop distribution are available (identify location)	Maps of crop distribution are available	Maps of crop distribution are available (identify location)	
Exposure response functions	Available, though will require extrapolation to ensure that all crops are covered (list functions)	Crop response to nitrogen is known.	To be confirmed	
Valuation data	World market prices for marginal impacts. Larger changes in production would need consideration of producer/consumer surplus, particularly under scenarios where cropping patterns change. (list sources)	World market prices for marginal impacts. Larger changes in production would need consideration of producer/consumer surplus, particularly under scenarios where cropping patterns change.	World market prices for marginal impacts. Larger changes in production would need consideration of producer/consumer surplus, particularly under scenarios where cropping patterns change. However, available evidence suggests that effects would be localised	World market prices for marginal impacts. Larger changes in production would need consideration of producer/consumer surplus, particularly under scenarios where cropping patterns change.
Specific uncertainties	1. Extrapolation between species and cultivars 2. Role of pests and pathogens	1. Impact in addition to management practices	Timing of ozone episodes in relation to other factors (rain, etc.) is critical.	
Additional information			Distributional impacts - a few farmers affected, most not.	
References	List references	List references	List references	List references

Can we deal with uncertainty?

- We routinely deal with uncertainty, especially on issues with major personal cost/benefit
- We need to constructively discuss uncertainties
- Tools are available
  - Routine statistical methods
  - Monte Carlo
  - Sensitivity analysis
  - Qualitative review of biases
  - …

My request (from yesterday)

- Response functions that tell us about a change in something that we value
  - What do we value?
  - Why do value it?
- Data that adds colour to the picture
- Qualitative information that aids interpretation, deepens understanding
- Information that is generalisable (not essential, but nice)
- And finally…something that can be monetised

My request today

- Response functions
- Contextual data