Valuing Impacts of Ecosystem Service Interactions

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Aim

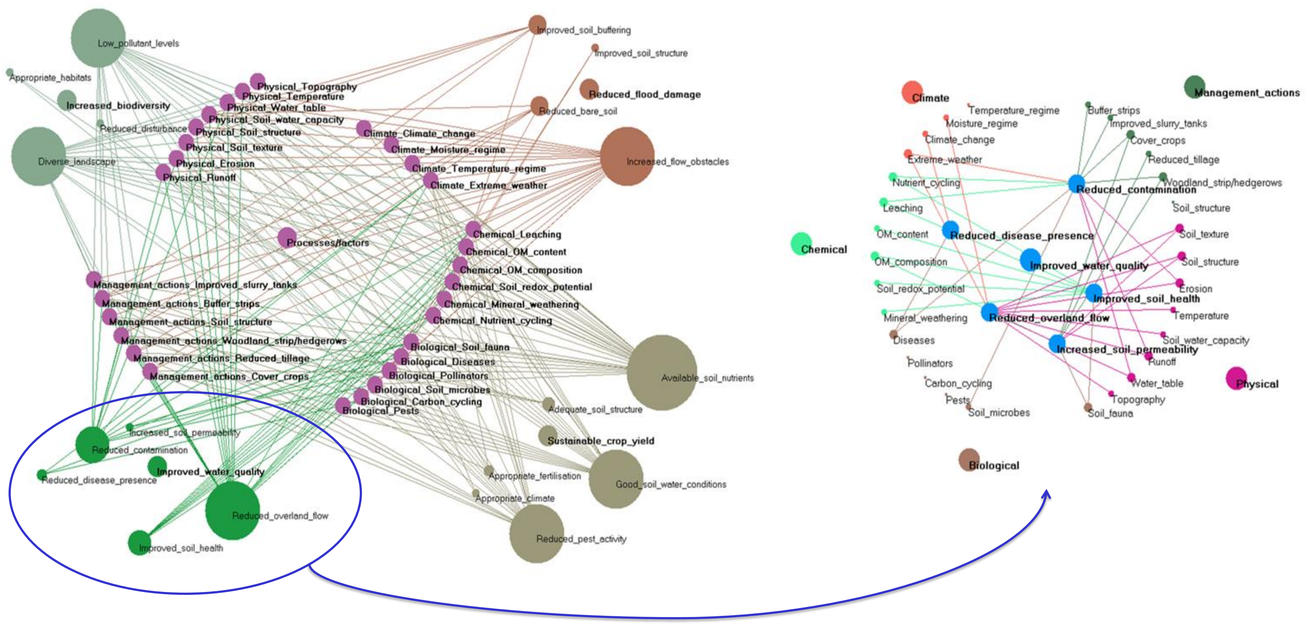
- Explore how interactions between ecosystem processes across different ecosystems affect the ecosystem services that contribute to human wellbeing.
- Understand how values are affected by these interactions.
- Design policy to optimise multiple benefits.

Research

- Eight natural scientists and four environmental economists formed a team to investigate how we can model interactions within and between terrestrial and aquatic ecosystems.
- A workshop held in February 2012 mapped out connections between ecosystem processes, ecosystem services, and management interventions related to specific policy aims.
- These mappings informed the development of Bayesian Belief Networks to explore a subset of key interactions.

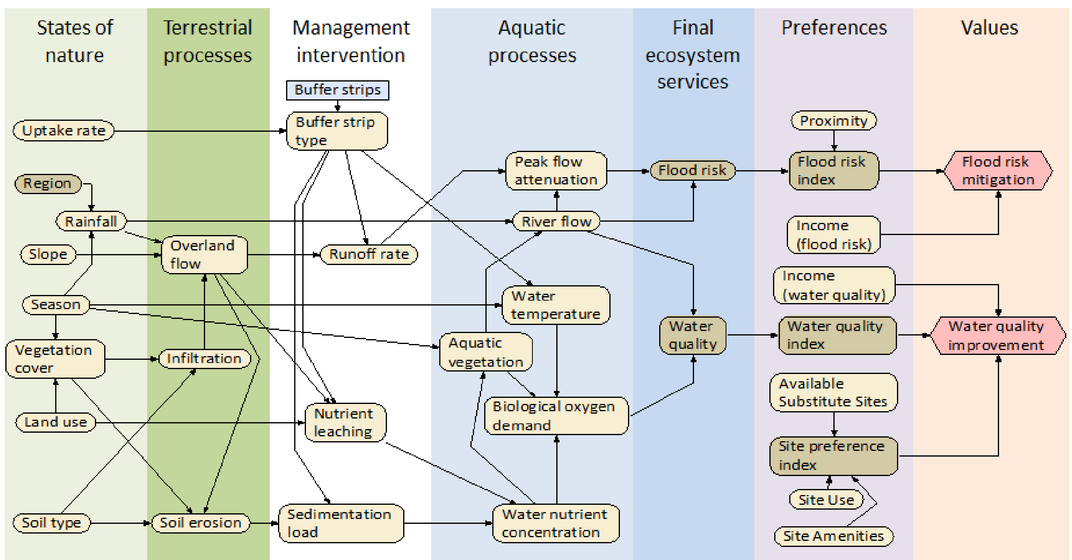
Findings

The workshop produced complex maps of connections between ecosystem processes. Even when reduced to a single policy objective these links are complex and need simplified to develop a workable model.



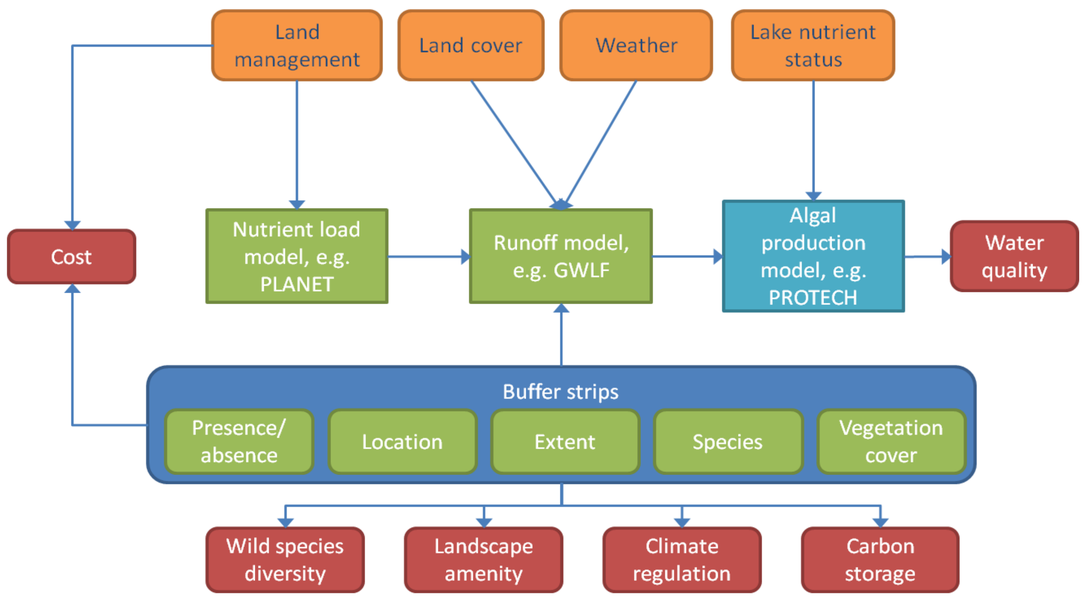
Links between policy outcomes, management actions and ecosystem processes (drawn using Attercap)

Bayesian Belief Networks (BBNs) were used as these do not require specific data on ecosystem process and service interactions, instead expert knowledge and judgement can be used. Crucially this approach allows an interdisciplinary understanding to form during the model development.



A BBN developed to explore water quality and flood risk outcomes and values from the use of buffer strips in stylised English agricultural landscapes

BBNs offer potential to extend existing biophysical process models to include a broader range of ecosystem services, benefits and values.



Integrating a BBN with biophysical process models (PLANET, GWLF, PROTECH) to consider multiple ecosystem services from buffer strips at Loweswater, Cumbria

Conclusions

- The complexity of ecosystem interactions poses a challenge in developing interdisciplinary models and understanding.
- Bottom-up approaches such as BBNs can address this challenge and offer potential for better decision-making.
- Challenges remain with respect to integrating values and valuation into the approach, for example due to the probabilistic or uncertain outcomes.
- This highlights inadequacies in existing valuation approaches in dealing with multiple probabilistic outcomes.

Next steps

- Develop BBN based ecosystem service and valuation extensions to existing biophysical process models using Loweswater in Cumbria as a case study.
- Explore how BBN models can be used as part of the valuation process to aid decision making to achieve multiple objectives.

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