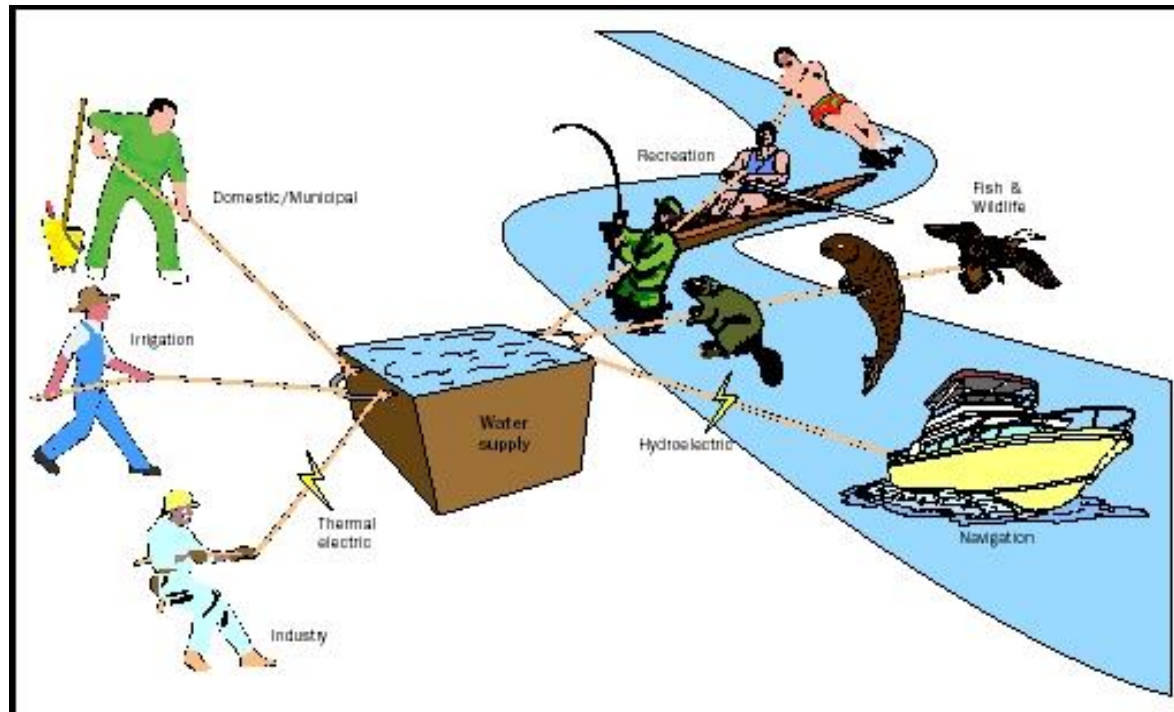


Tools for analysing trade-offs and synergies in ecosystem services



Ice-breaker issues regarding trade-offs

- **Characterisation**
- **Optimization**
- **Opportunity costs (understanding)**
- **Perceptions and attitudes/behaviours**
- **Cost-benefits analyses**
- **Negotiation (fair process / equity)**
- **Surety and uncertainty**
- **Timescales and spatial connections**
- **Monetary and non-monetary aspects (value judgements)**



Three parts...

- **Characterising ecosystem functions (biophysical component) using spatial planning tools**
 - Helaina Black
- **Communicating with stakeholders – demo**
 - Simon Langan
- **Analysing management options - integrating social, economic and environmental**
 - Bedru Belana



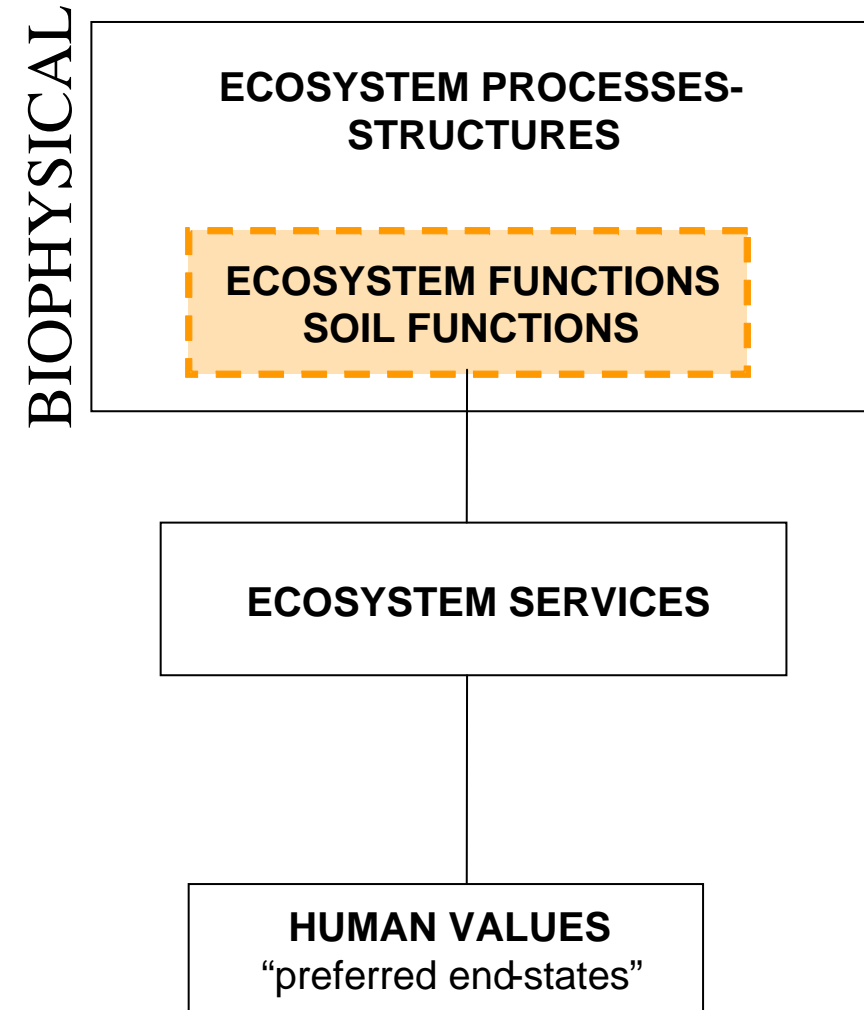
Have in mind ...

- **What tools do you need?**
- **What do you need them for?**
 - Over what spatial scales?
 - Over what timescales?
- **Would any of these approaches be useful to you?**
- **What are the constraints for you in assessing trade-offs and synergies?**
 - Biophysical
 - Ecosystem services



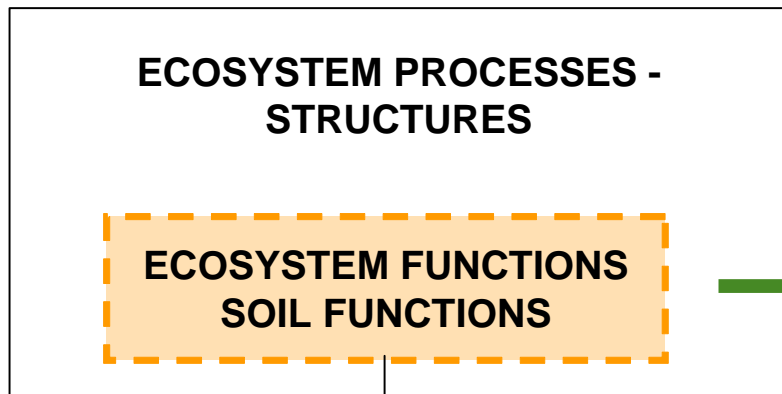


Characterising ecosystem functions



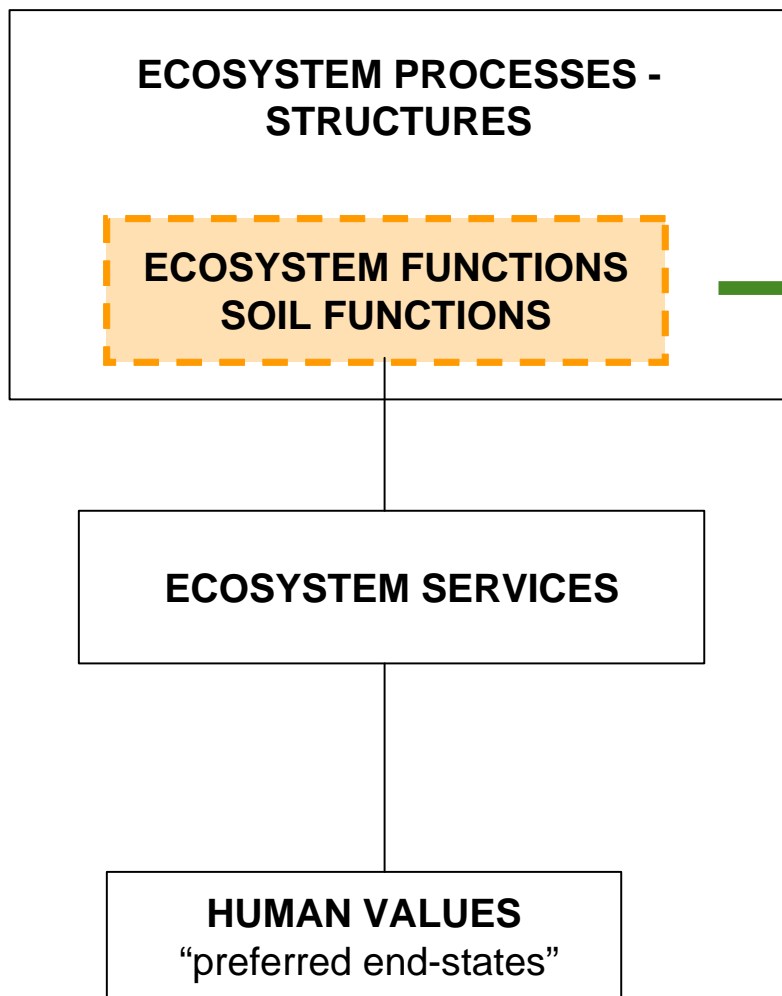
Characterising ecosystem functions

BIOPHYSICAL



Characterising ecosystem functions

BIOPHYSICAL



- *Functional approach brings together a wide range of properties and processes into more manageable concepts*
- *Tools available to characterise these in space and (sometimes) time*





Example – retaining carbon in an ecosystem




- **Type of vegetation and growth rates**
- **Litter fall and root inputs**
- **Activity of decomposer organisms in the soil**
- **Soil depth, texture and moisture characteristics**
- ***Land use, management, etc, etc***



Characterising ecosystem functions

| Soil Function | Description |
|----------------------------|---|
| Biomass production | Food, fibre and timber production |
| Environmental interactions | Filtering, buffering & transforming e.g. buffering of atmospheric inputs; biodegradation of toxic compounds |
| Supporting biodiversity | Biodiversity within the soil, and also supporting natural habitats associated above-ground flora and fauna |
| Physical medium | Base for built development and other human activities such as recreation |
| Source of raw materials | Supplying water, clay, sand, gravel, minerals, pharmaceuticals etc |
| Cultural heritage | Concealing and protecting archaeological remains; as a record of land use and settlement patterns |





Characterising ecosystem functions

- **Application of available environmental information within a spatial analysis framework e.g. geographical Information Systems (GIS)**
- **Support for decision making**
 - What there is
 - Where is it
 - How much is there (“quantity”)
 - What state is it in (“quality”)
 - Where is it in relation to other ecosystem functions
 - How do the functions interact
 - Assessing options and consequences of change
- **Resource base for evaluation and future planning**



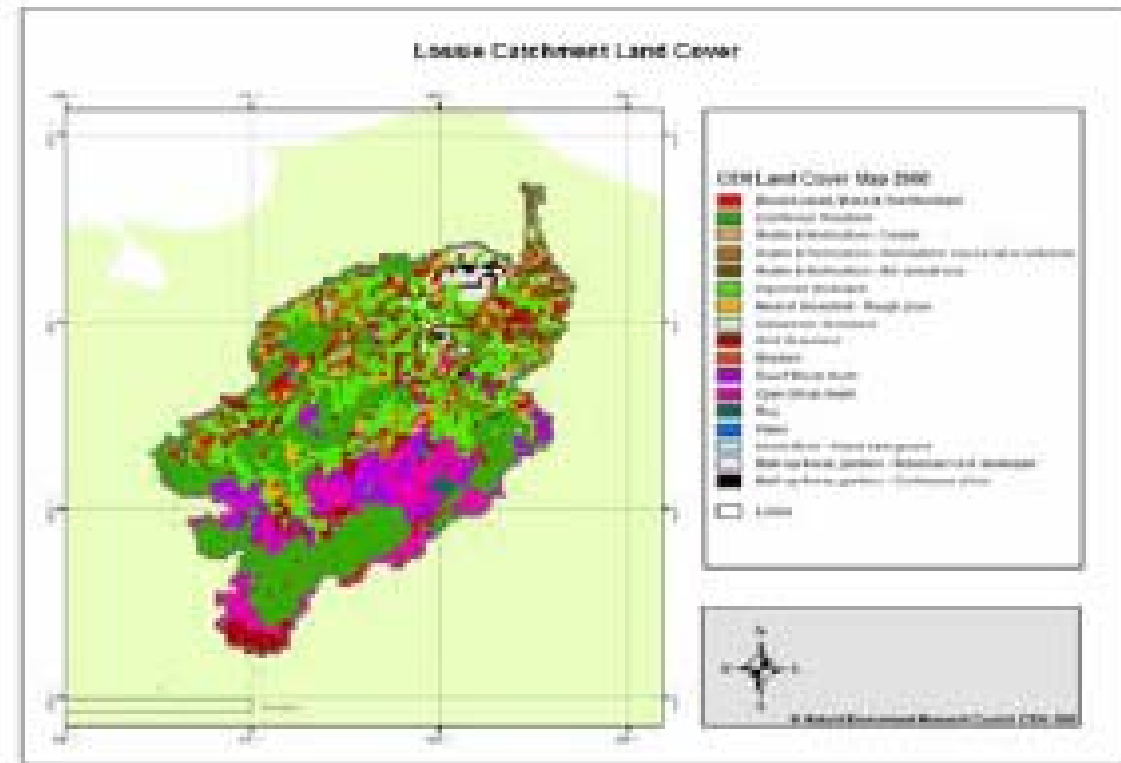
Current provision of ecosystem functions in a landscape (*biophysical characteristics*)

MAPS

- Land cover
- Conservation areas
- Soil carbon stocks
- Digital terrain
- River coverage
- infrastructure

SURVEY / MONITORING / CENSUS DATA

- Climate
- NPP – satellite imagery
- Crop yields
- Water supply and quality
- Environmental quality ... *indicators....*





Capacity for ecosystem functions in a landscape

MODELLING using available or predicted environmental data

Static models

Generally simple to use, less data needed, outputs often easy to communicate, difficult to assess change

Can be derived from expert knowledge e.g. rule-based

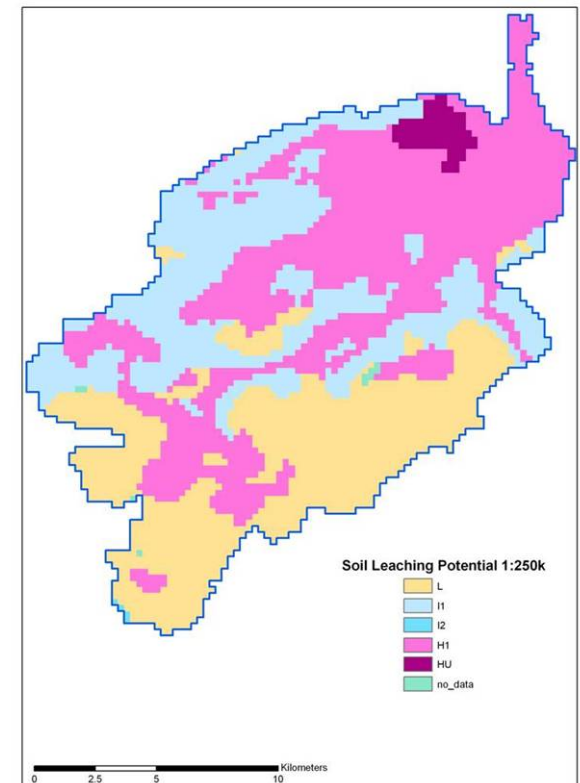
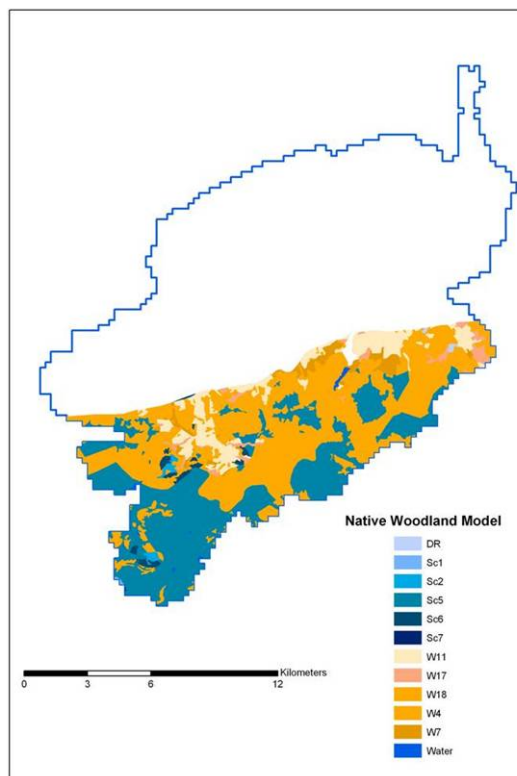
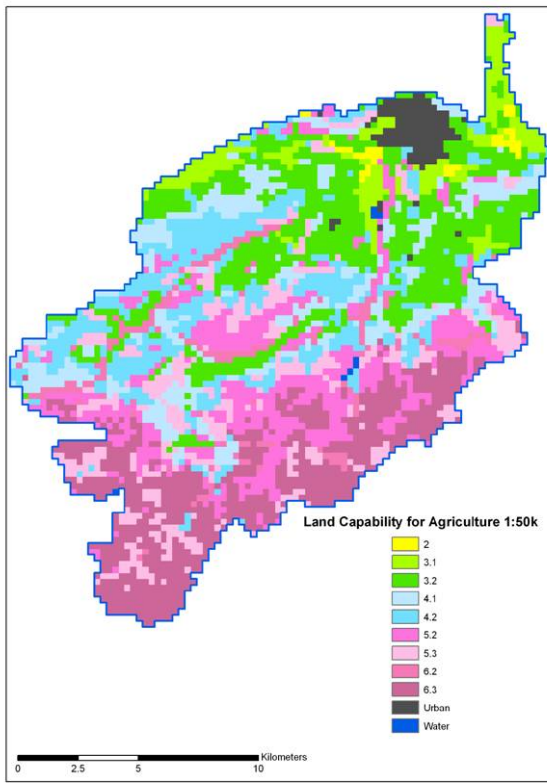
Dynamic models

Generally data hungry, can be complex to use, interpret and communicate but easier to assess changes and uncertainties

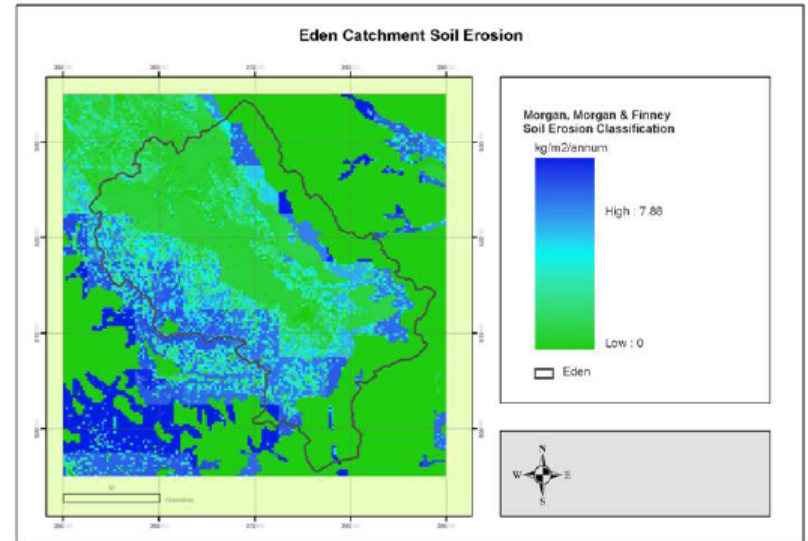
Often mechanistic and quantitative

- *How much function is possible give current ecosystem properties*
- *How much could function be improved?*
- *Which ecosystem properties can be managed to improve function?*
- *Over what timescale can changes be expected?*

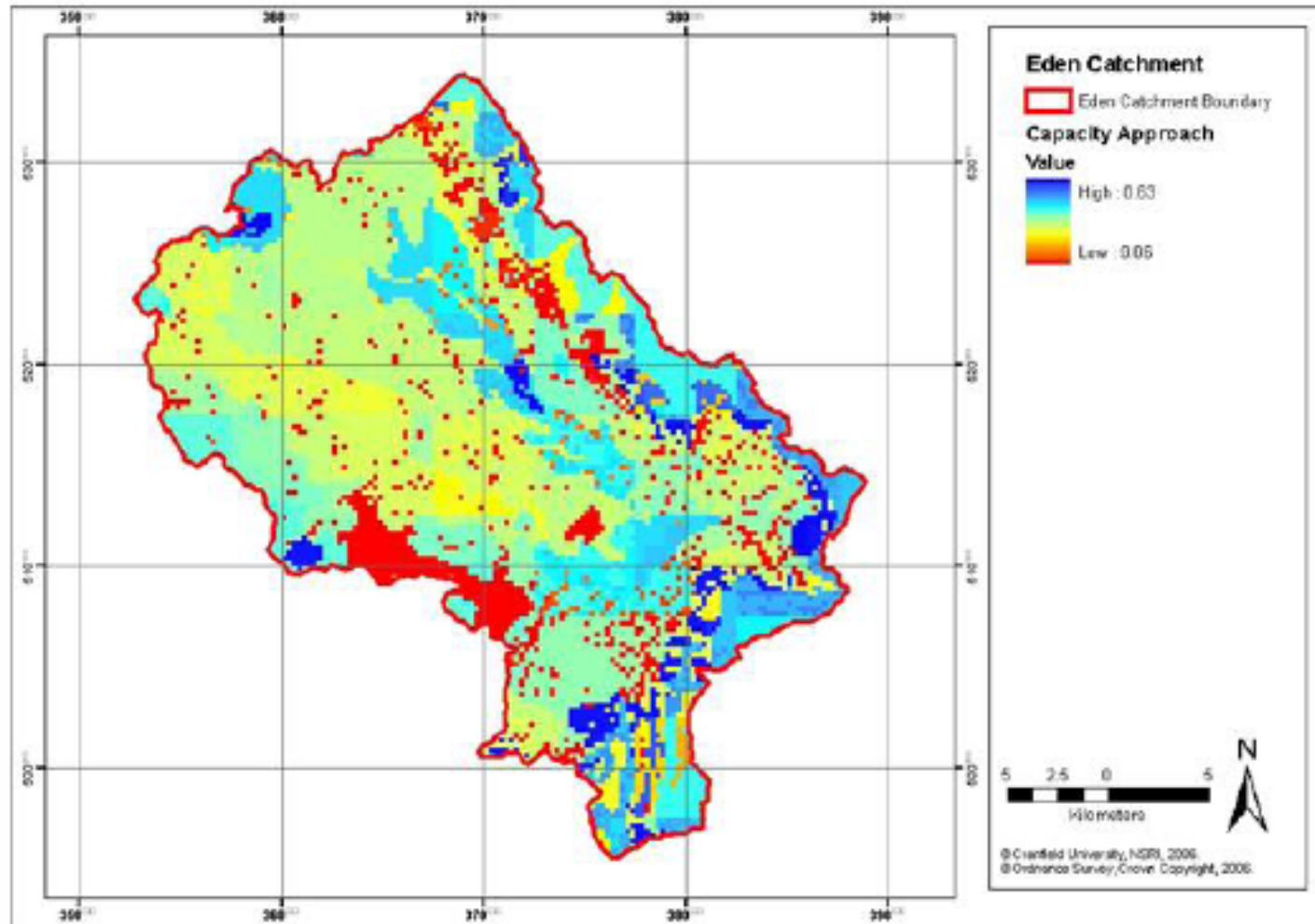




• Many models rely upon the same data
 e.g. soil carbon, texture, topography,
 nutrient levels, water availability,
 rainfall, vegetation ...
 But...
 data availability, transferable models,
 surety, GIS skills...



Spatial planning tools – interactions between ecosystem functions



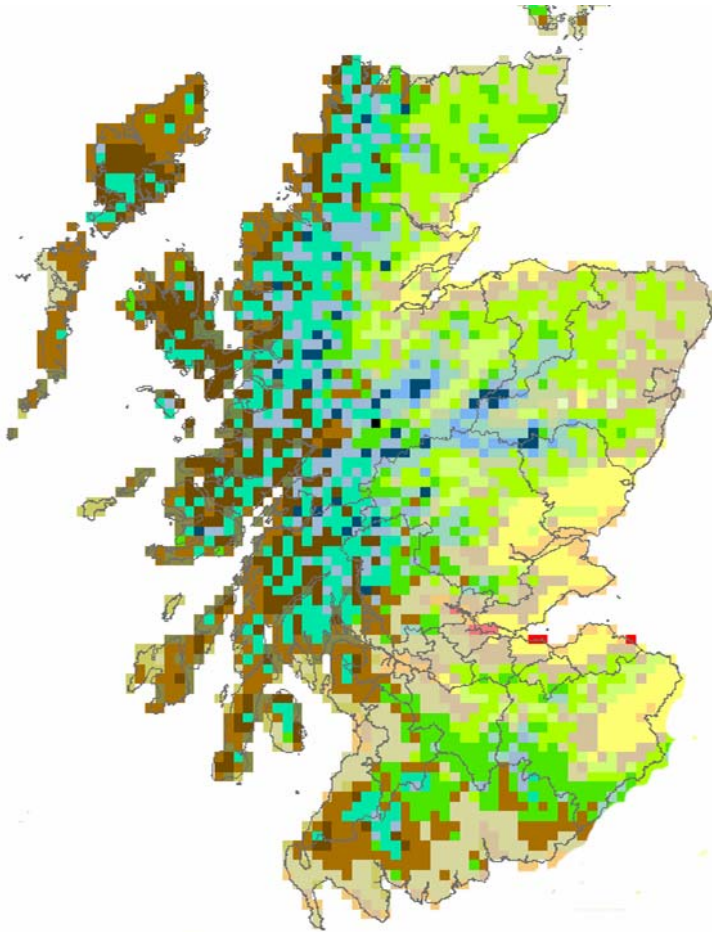
“Changing” environments *scenarios of the future*



- Land use and management changes
- Environmental
 - Pollution
 - Climate change

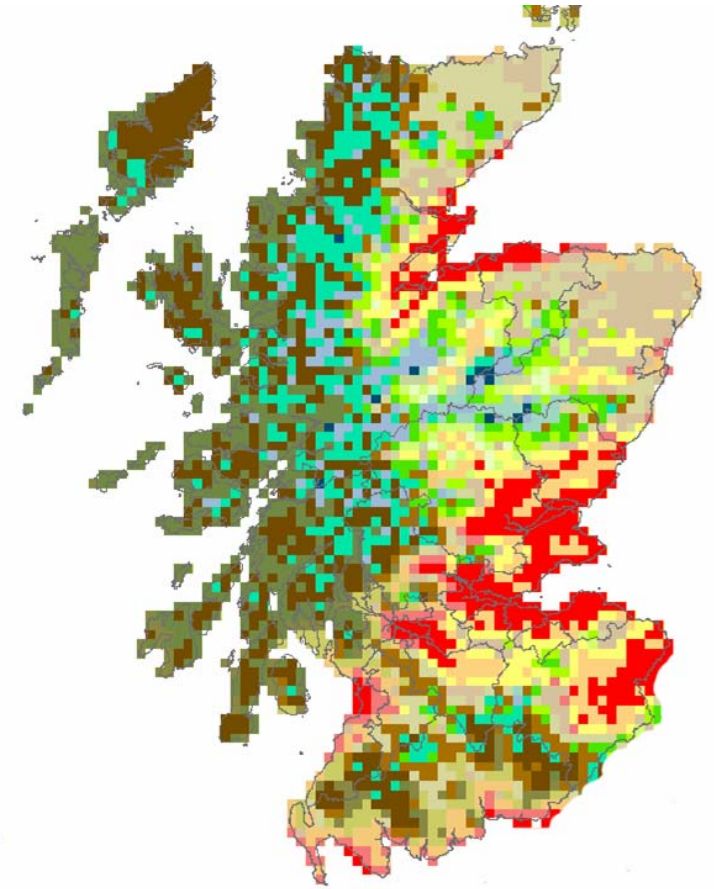


Climate change



1981-2000

- extreme cold + v wet
- v cold + v wet
- v cold + wet
- v cold + rather wet
- cold + v wet
- cold + wet
- cold + rather wet
- cold + moist
- cold + v wet
- cool + v wet
- cool + wet
- cool + rather wet
- cool + moist
- cool + rather dry
- mild + v wet
- mild + wet
- mild + rather wet
- mild + moist
- mild + rather dry
- mild + dry
- warm + v wet
- warm + wet
- warm + rather wet
- warm + moist
- warm + rather dry
- warm + dry

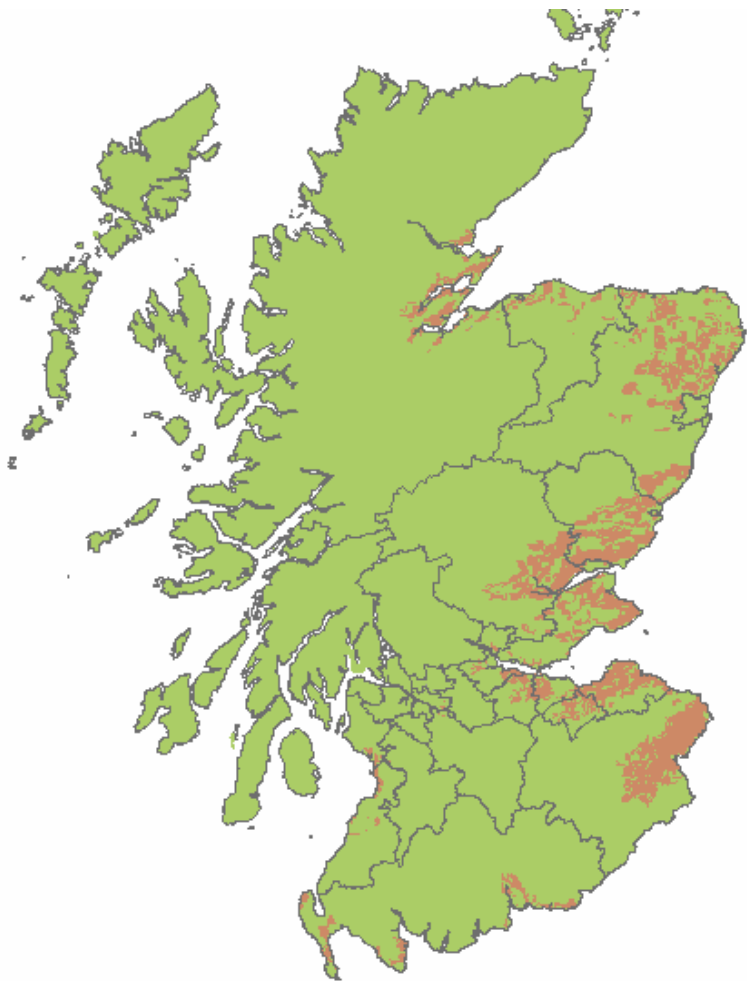


2050s [Med-High Scenario]

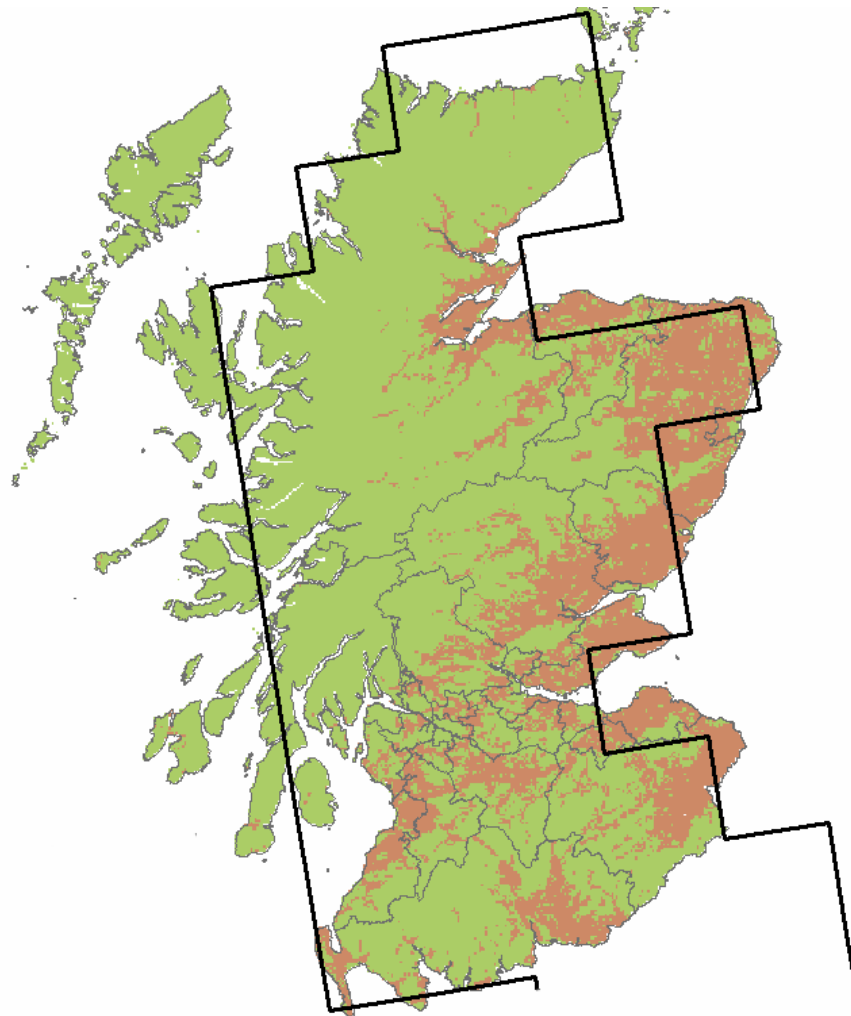
What does this mean for agricultural production?



Capacity for agriculture



1981-2000



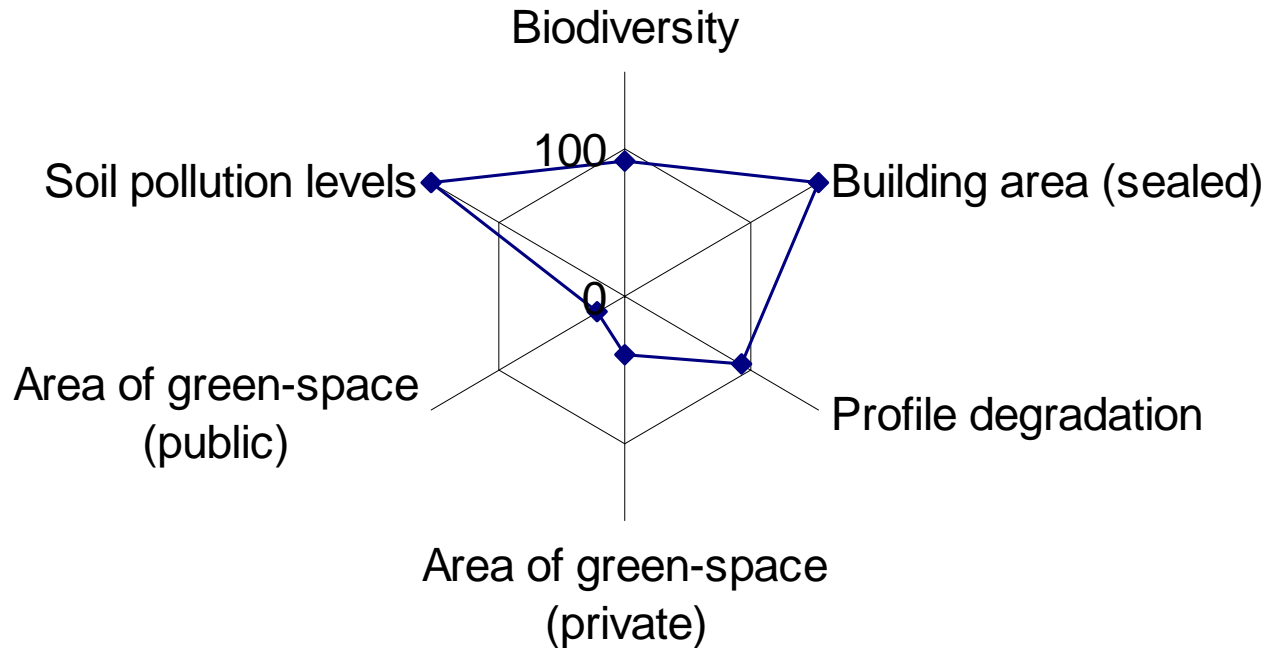
2050s – UKCIP02 Med High Emissions

Emissions
Potential large gains in prime land



Stakeholder engagement tools - interactions between ecosystem functions

Imbalanced

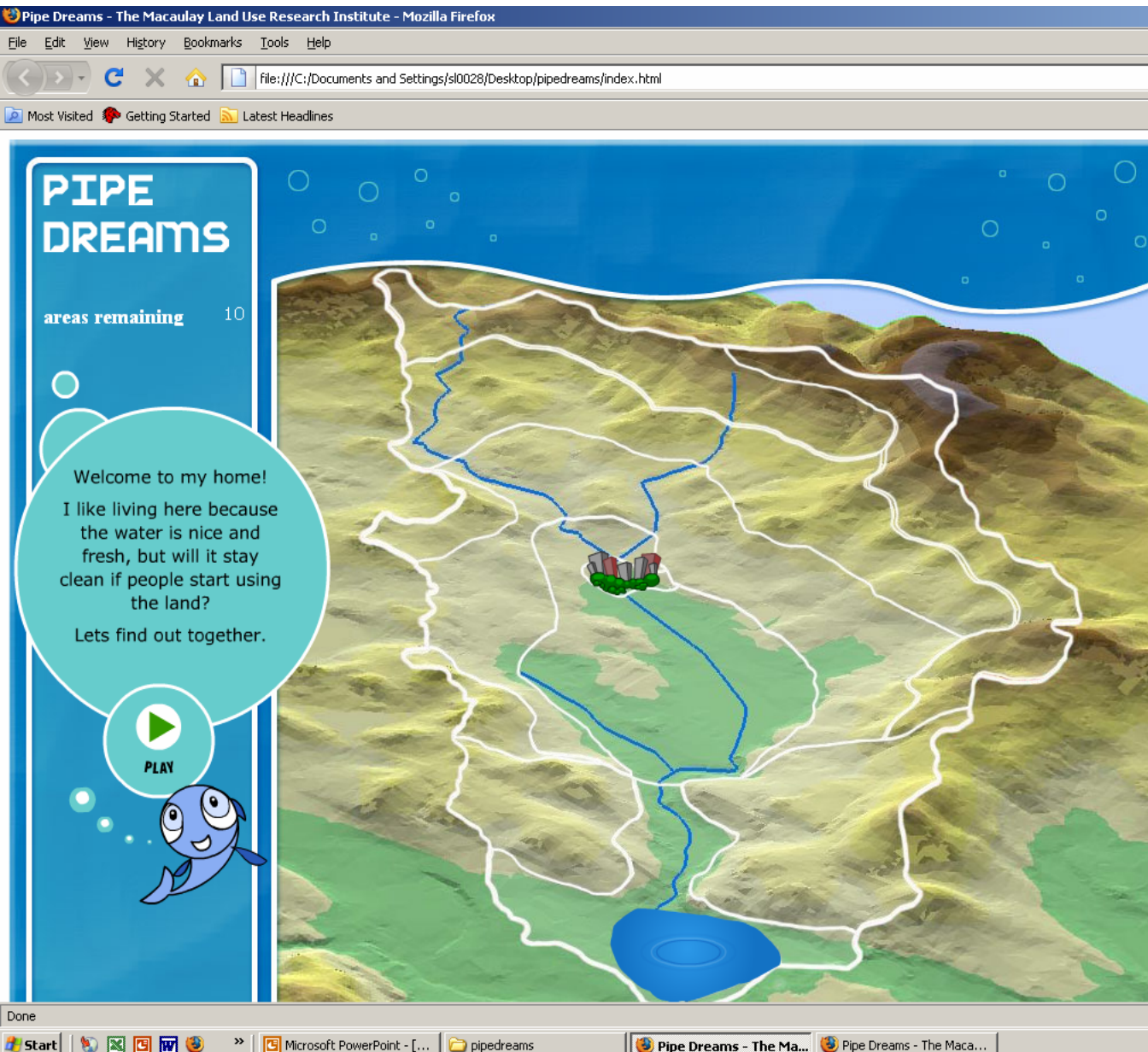


Communicating trade offs

- **Example of graphic/ pictorial model**
- **Uses spatial representation of land use parcels in a catchment context**
- **Model used to examine potential impact of different land uses on water quality, livelihoods and sustainability**
- **Currently set in a Scottish/ European context**



Model: PIPE DREAMS



- Slope/land suitability
- 10 land parcels
- Choice of 7 land uses

Grouped:

- Crops
 - Livestock
 - Mono forest
 - natural
- 5 class outcome for:
- Environmental
 - Food
 - Economic

Facilitated use of model

- **Break into 5 groups, set-up and run model**
- **Review and discuss model:**
 - Was it useful?
 - Should we consider developing and adapting it for PRESSSA
 - How?
 - Who might use it?
- **Please record discussions for trainers**





Resolving trade-offs and synergies

- **Tools to assess**
 - now and the future
 - implications of climate change
 - range of options
 - locations
 - management
- ***No single definition of success***
- **Support to successful management & planning**
 - integrative & collaborative involvement of all stakeholders

