Mapping and spatial valuation of ecosystem services in the province of Telemark, Norway

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Problem description and relevance
Human alteration of ecosystems leads to decline in ecosystem services (ES) provision, due to

- assumed trade-offs with other private or societal goals
- insufficient knowledge on the ES benefits

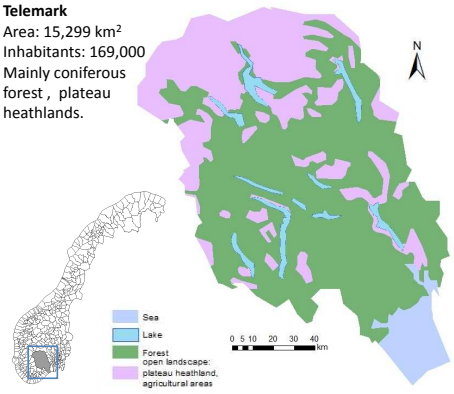
Solution and research objective
Quantify and value ES to fully recognise the contribution of ecosystems to human welfare. Untangle trade-offs.

The case of Telemark, Norway

- decline of undisturbed areas,
- cultural landscapes face natural succession
- expected high impact of climate change

⇨ threatening biodiversity, trade-offs between ES

Telemark
Area: 15,299 km²
Inhabitants: 169,000
Mainly coniferous forest , plateau heathlands.




crops


livestock


fibre/fuel


wild food


non-timber forest products


climate regulation


land and snow slide prevention


recreation

Research questions

Research framework

Methods

Which ES are most important for the study area?

Identification of ecosystem services

Expert and local stakeholder consultation, analysis of current land use, national vegetation atlas of Norway.

How can we derive ES from land cover/land use data?

What is the spatial relation between ES service providers and beneficiaries?

Are there bundles and hot spots of ES? What are the trade-offs between different forms of ES?

Where do priority areas for biodiversity conservation overlap with ES hotspots?

Analysis of spatial distribution and abundance

ES providers
(ecosystem functions determine the capacity and stocks)
SUPPLY

⇔

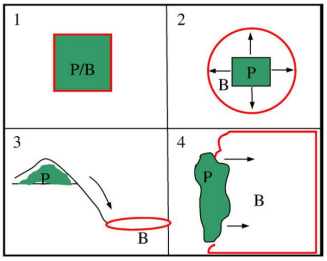
ES beneficiaries
(stakeholders needs and values determine actual use)
DEMAND

Spatial analysis

- GIS analysis of land cover/ land use data
- remote sensing techniques
- geospatial statistics

Spatial flow analysis framework (see fig.)

Service production (P) and benefit (B) can co-occur spatially (1); ES flow can be omnidirectional(2), or directional (3 [downstream], 4).



(Fisher et al. 2009, Ecol Econ)

What is the total biophysical amount of ES produced p.a.?

Quantification of annual ES flow
$q_t = f$ (supply, demand)

Spatially adjusted ES provision in a biophysical accounting system for the province.

What is the total value added of ES on a subnational level?

Valuation of ES: value added
$\partial v = \sum$ marginal benefits - $\sum$ marginal costs

Economic valuation methods

- market prices (fibre/fuel, non-timber forest products, wild food, crops, livestock)
- travel cost method (recreation)
- replacement cost (disturbance prevention)
- contingent valuation method, deliberative monetary valuation (bundles)

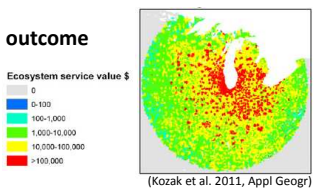
On which factors do ES values depend spatially?

Spatial modelling of ES values
$\partial v = f$(distribution, abundance of supply and demand, proximity of alternative uses, ...)

Combining space and value: expected outcome

- distance decay functions

Example of a map of spatially explicit values of wetland ES



(Kozak et al. 2011, Appl Geogr)

How should ES be counted in extended accounting systems?

Ecosystem services accounting

Gross Domestic Product (incl. marketed ES) + *net* value of non-marketed ES (= excl. value of supplementary goods and services already counted)