Assessing ecosystem services trade-offs using climate change adaptation scenarios with special focus on forest ecosystems

Vačkář, D., Harmáčková, Z., Pártl, A., Grammatikopoulou, I., , Streberová, E., Sylla, M., Lorencová, E.

Global Change Research Institute (CzechGlobe) The Czech Academy of Sciences Department of Human Dimensions of Global Change





Theoretical background

- Humans transform ecosystems to harness valuable goods and services, by competing demands
- The extent of this transformation on many occasions exceeds the intensity and rate of natural processes (we are entering an Anthropocene...)
- Ecosystems and services are often being degraded beyond sustainability limits and planetary boundaries
- There is a need to incorporate ecosystem services into decisionmaking to improve the state of ecosystems and the planet



David Vačkář, Zuzana V. Harmáčková, Helena Kaňková, Kateřina Stupková Human transformation of ecosystems: Comparing protected and unprotected areas with natural baselines

Ecological Indicators, Volume 66, 2016, 321–328



J. Foley et al., Science, 2005.

Integrating ecosystem services into the decision-making

- Support tools for decision-making about trade-offs between different policy options
- Involvement of local stakeholders in decision-making
- Case studies from UNESCO Biosphere Reserves: Třeboňsko Protected Landscape Area and Šumava National Park



Systems

Ecological

Social



The Šumava National Park CBA

- Conservation regimes: National park, Protected Landscape Area, UNESCO Biosphere Reserve
- One of the largest forested mountainous areas in Central Europe (together with neighbouring Bavarian Forest NP)
 - Spruce forests
 - Glacial lakes
 - Peat bogs
 - Mountain meadows
- One of the major
 European watersheds
- Management conflicts



Conceptual approach combining ecosystem services and climate change adaptation

Climate change impacts

Possible adaptation actions

Participative scenario building

Ecosystem services modelling

Cost-benefit analysis

Nature-based (ecosystem) adaptation measures

Sustainable forest management:

- Choice of tree species, heterogeneous age structure, ...
- Peat land restoration
- Landscape management:
 - Enlarged core zones of the national park





Examples of adaptation measures for forests

- Reforestation in areas affected by emissions, wind storms and barkbeetle outbreaks
- Replanting aimed to diversify tree species and stabilize the degraded ecosystems
- Choice of tree species (origin, genetic properties)
- Increased share of deciduous species (droughts, storms, pest outbreaks, diseases)
- Reforesting with species tolerant to low soil moisture and high temperature
- Promote diverse age classes and species mixes, a variety of successional stages, and spatially complex and heterogeneous vegetation structure.
- Decreased canopy bulk densities in thinned stands, with concurrent treatments to abate surface fuels, to mitigate wildfire risk (however, not all forest landscapes and stands are amenable to thinning, nor is it ecologically appropriate in some upper-elevation forest types)
- Forest aisles against forest fires

Series of participatory scenario workshops

Scenario workshop *"Sustainability visions of the Šumava* National Park in a changing world" (27/7 & 5/11 2014)











Adaptation scenarios

- Based on storylines developed by stakeholders
- Time horizon: 2050
- LULC change matrix for each storyline
- Data:
 - CORINE Land Cover 2006
 - ALARM BAMBU 2050/ EcoChange scenarios
 - Climatic data based on RCP (4.5) scenarios
 - Stakeholder input





InVEST modelling process

InVEST

integrated valuation of ecosystem services and tradeoffs



Carbon sequestration



Hydropower production



Results:

- Nature conservation scenario most beneficial in terms of future benefits
- Economic development scenario presenting a negative net present value



Results reported for RCP 4.5, discount rate 1%, mean marginal costs and ES unit values

Ecosystem service trade-offs



Methodological framework for the national ecosystem services assessment



Economic value of ecosystem services



Frélichová, J., Vačkář, D., Pártl, A., et al., Ecosystem Services, Vol. 8, 2014.



Assessing impact of land use and climate change on regulating ecosystem services in the Czech Republic

Ecosystem management in transition in Central and Eastern Europe **Ecosystem Health** and Sustainability Volume 2, Issue 3, 25 MAR 2016 DOI: 10.1002/ehs2.1210 http://onlinelibrary.wiley.com /doi/10.1002/ehs2.1210/full# ehs21210-fig-0002



Thank you

vackar.d@czechglobe.cz

Global Change Research Institute (CzechGlobe) The Czech Academy of Sciences Department of Human Dimensions of Global Change





