An economic view on ecosystem services from agriculture

Erwin Schmid

Institute for Sustainable Economic Development

Department of Economics and Social Sciences
University of Natural Resources and Life Sciences

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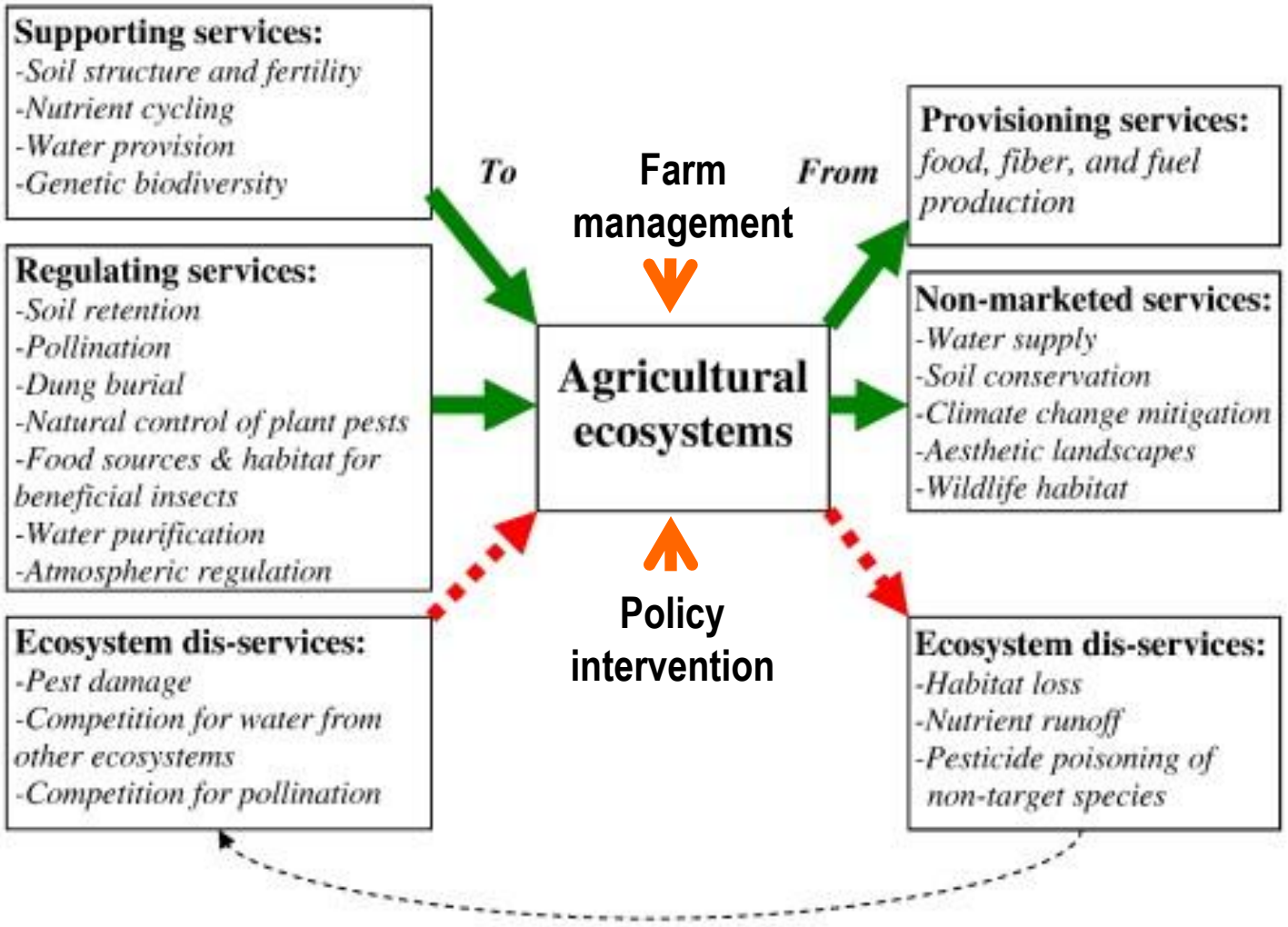
Outline

- The concept of Ecosystem Services (ES)
- Grand Challenges
- Economic aspects
  - Economic Valuation
  - Benefits and Costs
  - Trade-off Evaluation
- Case Study Example
- Conclusions
- Outlook

The Ecosystem Service (ES) Concept

- aims at providing an effective framework for natural resource management decisions.
  ...direct and indirect contributions of ecosystems to human well-being (MEA, 2003; TEEB, 2010).
- Receives attentions from scientists and policy makers.
- Scientific literature shows ambiguity in definitions and classifications e.g. ecosystem processes, functions, services, benefits & costs as well as in applying it to decision making.
- Critique: e.g. Boyd and Banzhaf (2007), "…ecology and economics have failed to standardize definition and measurement of ES...".

Ecosystem Services and dis-services *to* and *from* agriculture



Feedback effect of dis-services from agriculture to agricultural input (e.g., removal of natural enemy habitat can encourage pest outbreaks)

Zhang et al., 2007 (modified)

Grand challenges

- Indicators and measurement (monitoring)
- Double counting (=> intermediate and final goods & services)
- Stocks versus flows
- Scale (i.e. field, farm, landscape, global eco-region)
- (Economic) Valuation of ecosystem services
- Costs and benefits (asymmetric distributed)
- Evaluating trade-offs between ecosystem services and derive implications for policy making

The Use of Economic Valuation

1) We want to determine the *optimal level* of policy intervention (i.e. costs and benefits)

2) We want to value the total amount of environmental pollution and degradation e.g. including in the national economic accounts

3) We want to calculate compensation polluters need to pay victims (negative externality), or beneficiaries to producers (positive externality).

Concept of Total Economic Value (TEV)

= actual use value + option value + quasi option value + intrinsic value

- **Actual Use Value** = arises from the actual or planned use of the service by an individual.
- **Option Value** and relates to willingness to pay to guarantee the availability of the service for future use by the individual.
- **Quasi-Option Value** relates to willingness to pay to **avoid an irreversible** commitment to development now, given future knowledge.
- **Intrinsic Value** arises from knowledge that the service exists and will continue to exist, independently of any actual or prospective use by the individual.

Benefits and Costs

- **Benefits**
  - Market benefits
  - Non-market benefits (e.g. public goods)
- **Costs**
  - Direct costs
  - Opportunity Costs
  - External Costs

Approaches to Evaluating Trade-offs

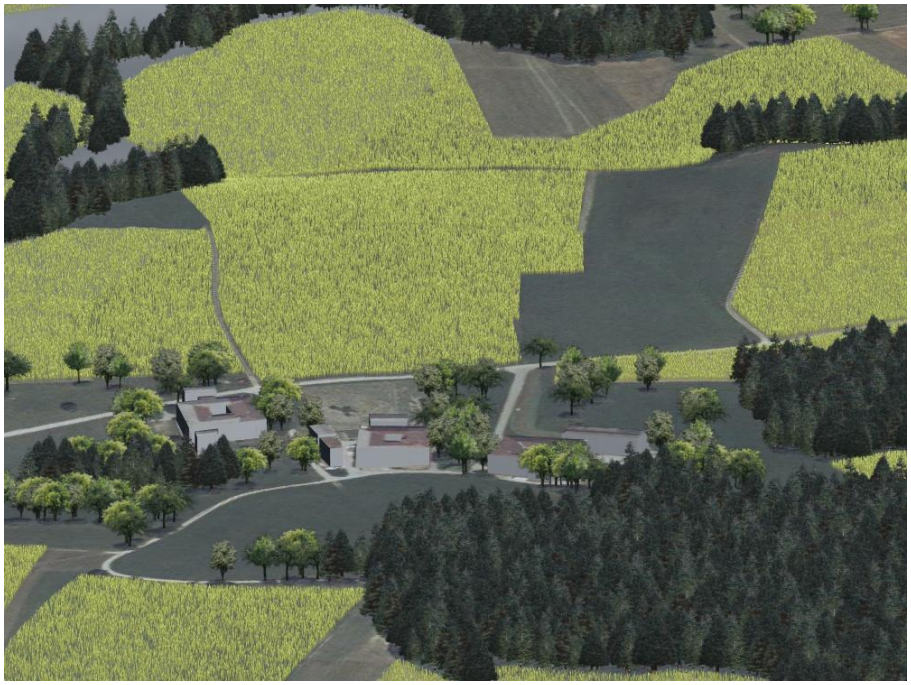
- **Cost-Benefit Analysis**
  - Pros: evaluates trade-offs between benefits and costs.
  - Cons: intangibles.
- **Cost-effectiveness Analysis**
  - Pros: policy targets are attained at least costs.
  - Cons: equal treatment of policy targets.
- **Multi-Criteria Analysis**
  - Pros: policy options are ranked with respect to criteria.
  - Cons: obtaining consistent preference structure (experts, stakeholders).

Case Study Example

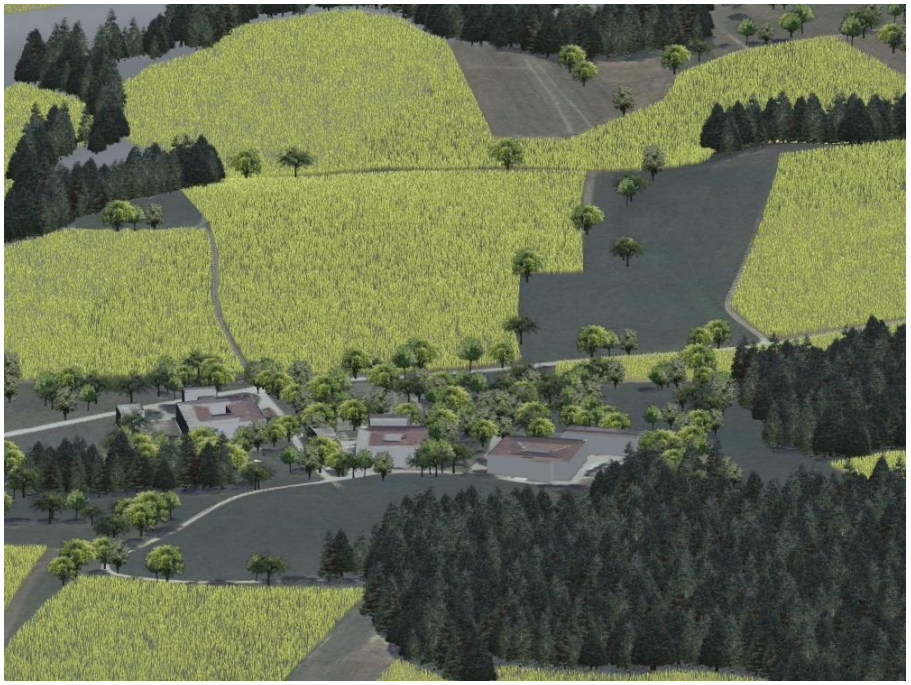
North-East Neuhofen an der Ybbs South-West

Loss of landscape elements through agricultural intensification
In response => agri-environmental measures (ÖPUL)
Assessing the opportunity costs of ES from orchard meadows

Ecosystem Services from orchard meadows in a landscape region

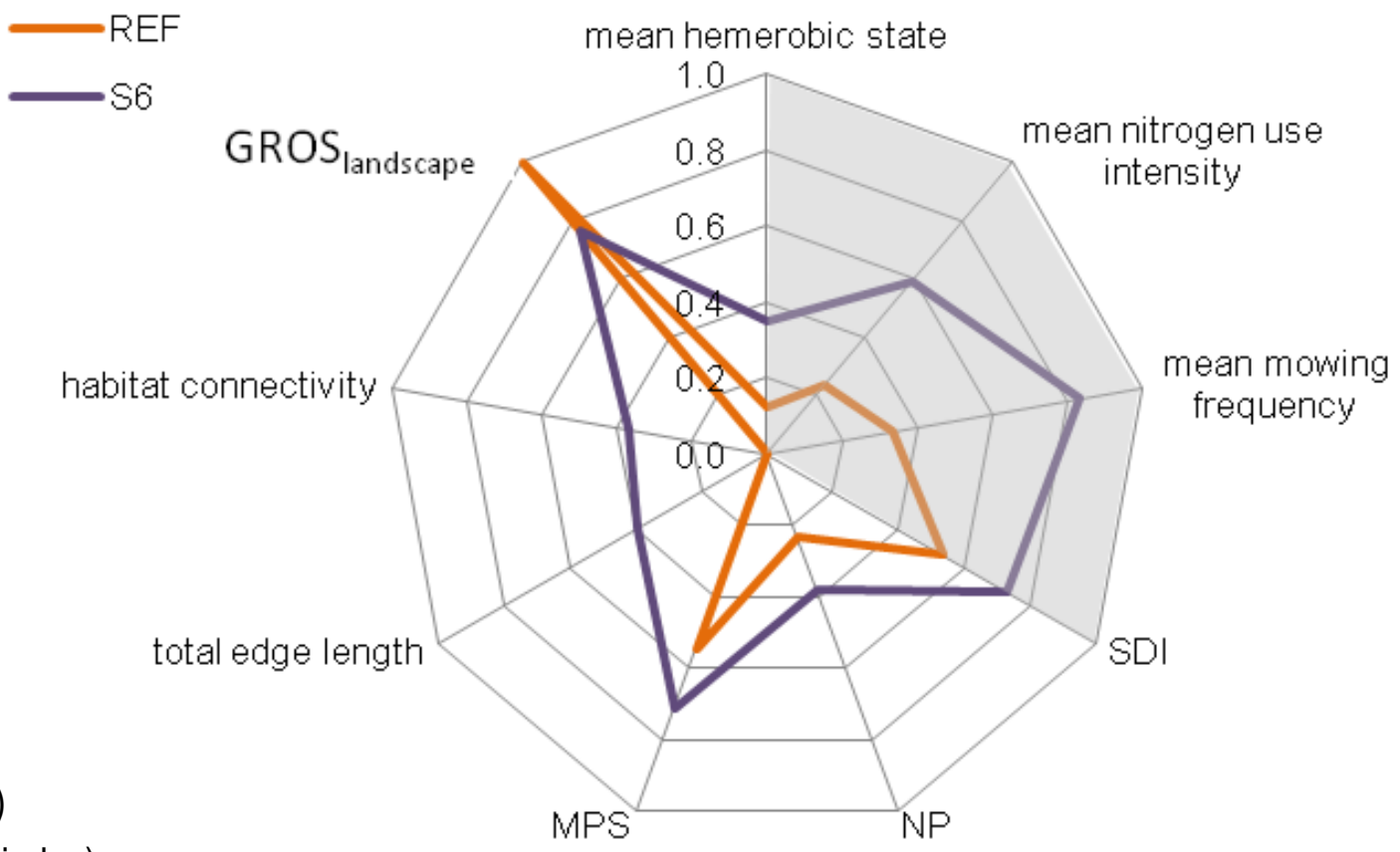


„current“
Orchard Meadows (2002)



Historical
Orchard Meadows (1953)

Without agri-environmental measures (REF) and with agri-environmental measures (S6)



Legend:

MPS (mean patch size)

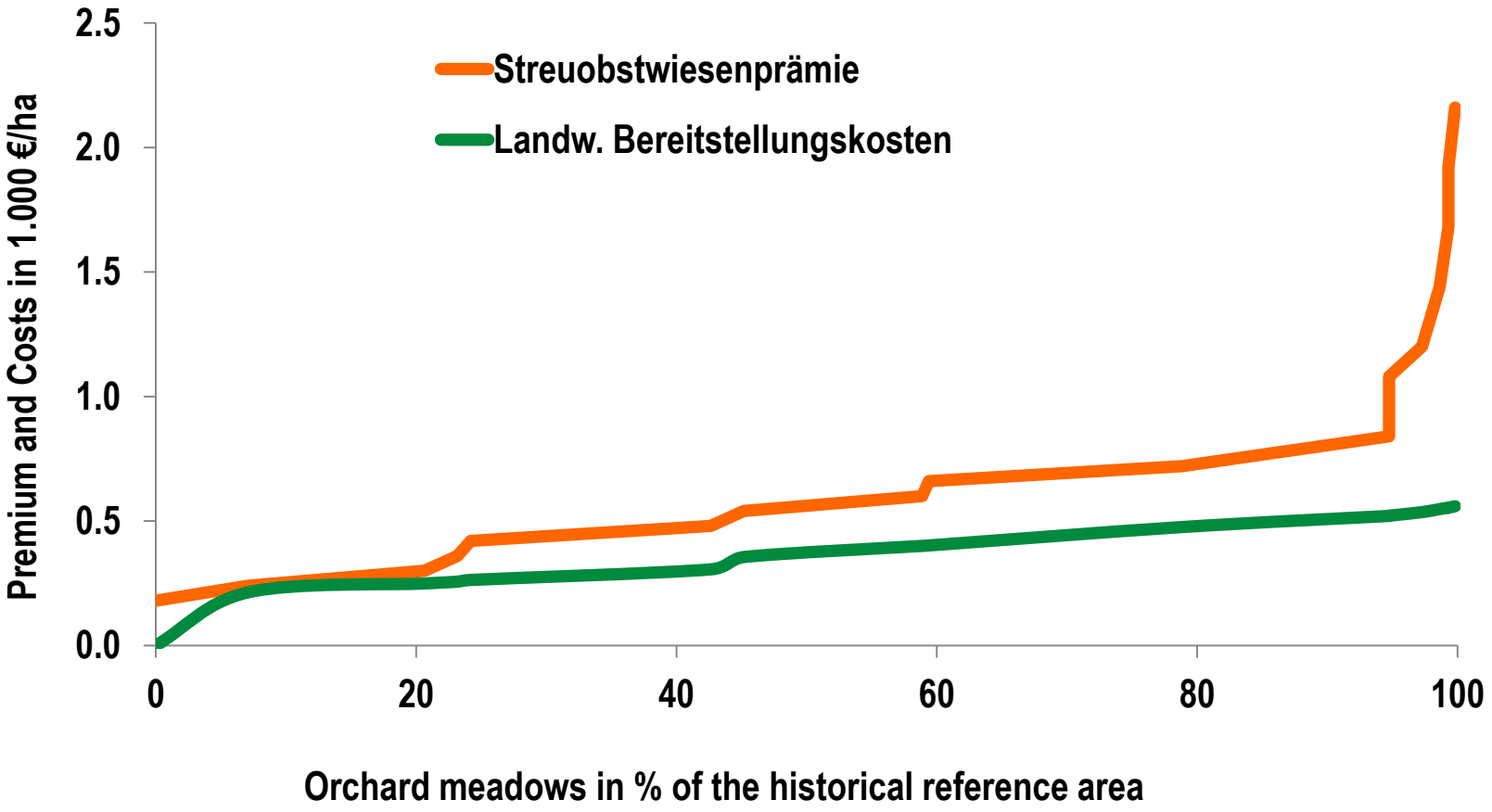
NP (number of patches)

SDI (Shannon diversity index)

$GROS_{landscape}$ (Total farm net-returns)

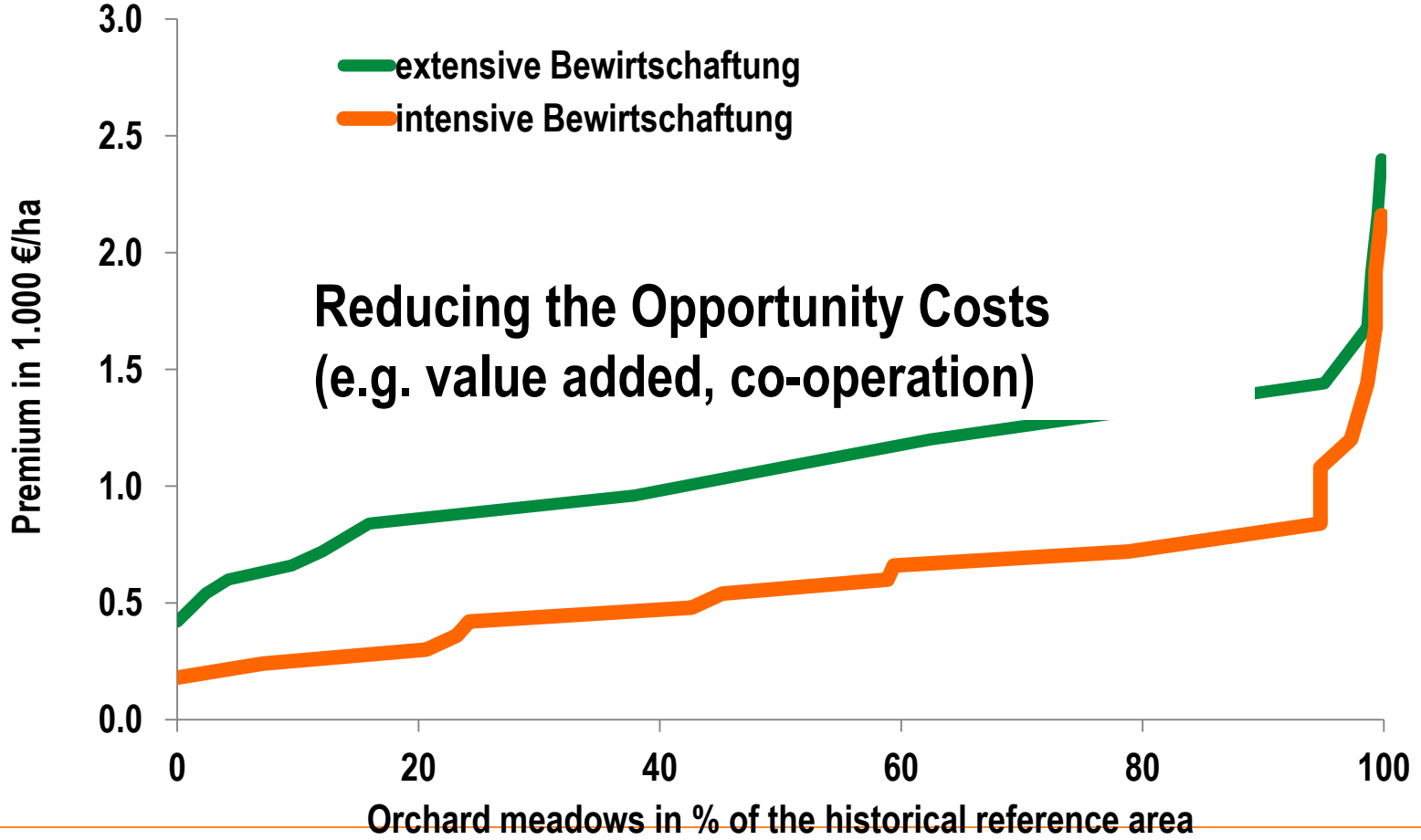
Schönhart et al., 2011

Opportunity costs and premiums for orchard meadows in 1.000 €/ha



Schönhart et al., 2011

Premiums in relation to management intensity in 1.000 €/ha



Schönhart et al., 2011

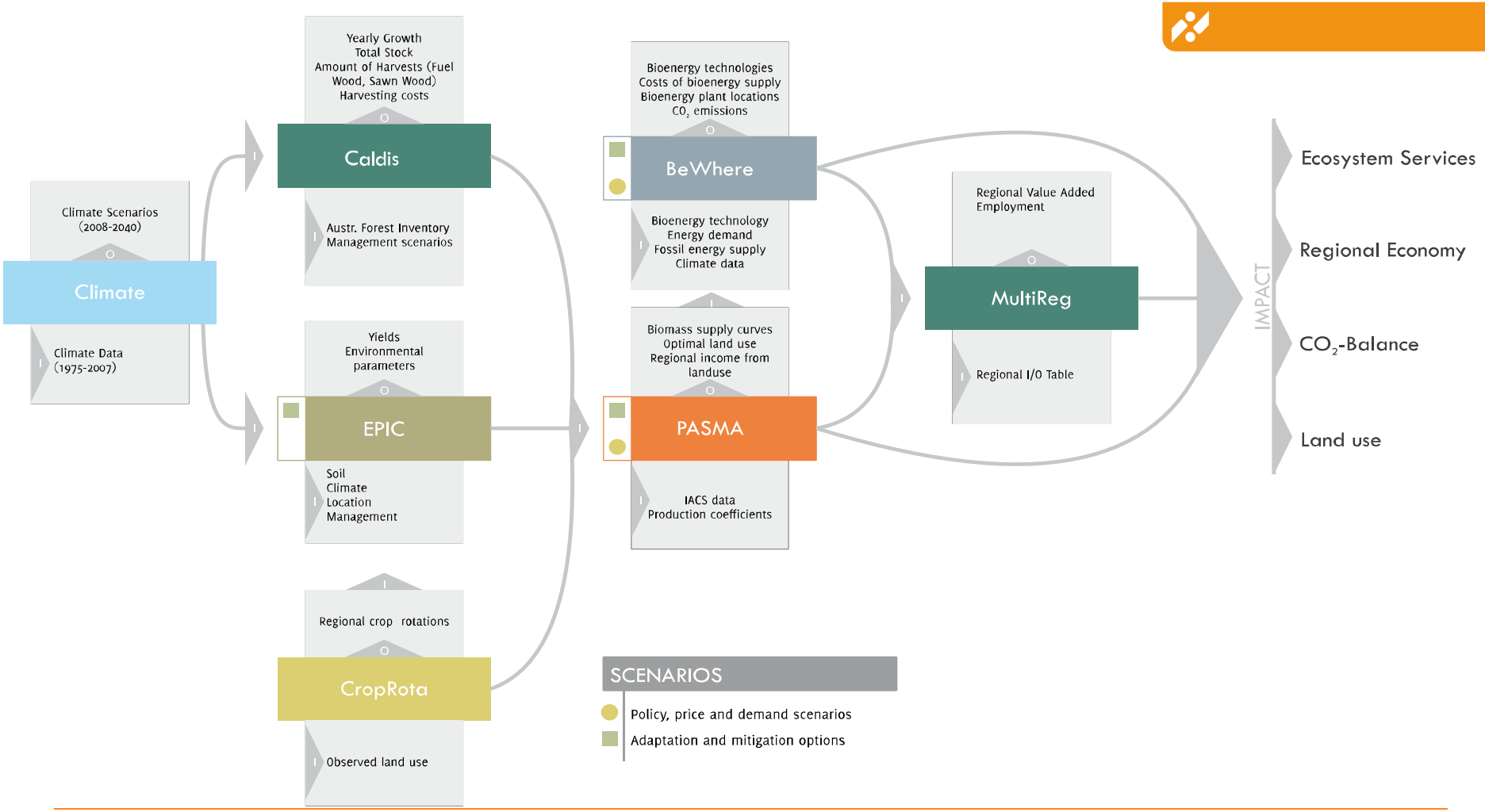
Conclusions (I) Concept of ES

- The concept of ecosystem services provides opportunities to integrate scientific disciplines, data, models, indicators etc.,
- but issues on scale, context, valuation, and trade-off evaluation make it difficult to finding universal definition and measurement.
- …we only can manage and govern what we can measure and we need a concept (Stiglitz, Sen, and Fitoussi, 2009, Report by the Commission on the Measurement of Economic Performance and Social Progress).
- There are many opinions about the “correct” concept.
- Even if the current concept is correct, we know that measurement is not perfect and complete.

Conclusions (II): Agricultural management

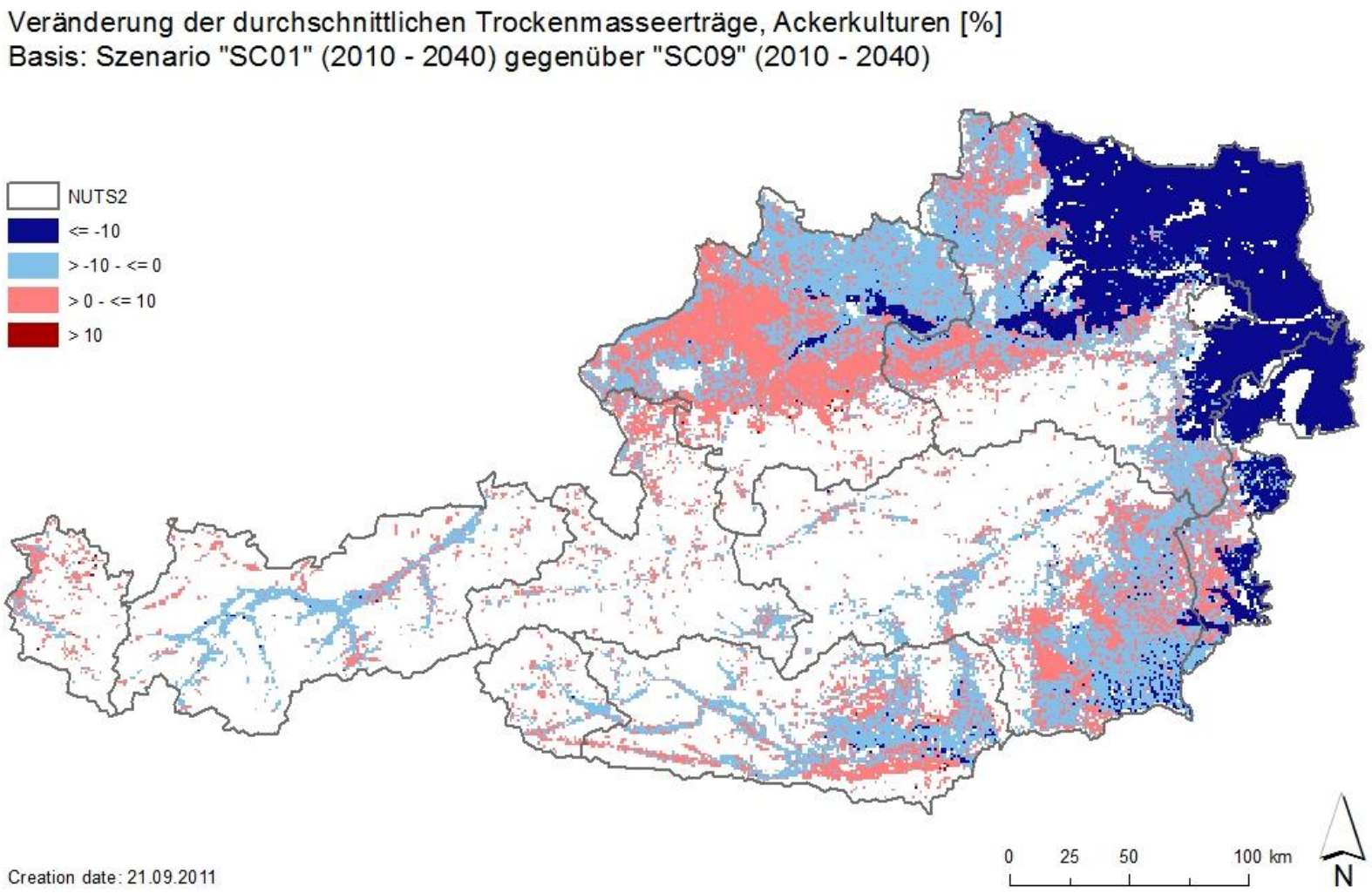
- **Goal orientation and Targeting**
  - It is about the goal and not about a specific measure.
  - Measures should be implemented only where they are needed (e.g. agri-environmental measures).
- **Regulation and Compensation Mechanism**
  - Provide proper incentives (min. adverse selection & moral hazard).
- **Integrated Approaches and Trade-Offs**
  - Foster Integrated Approaches i.e. bio-pyhsical & economic systems.
  - Jointness in production.
  - ES and their contributions to land values.
  - Trade-offs are practically unavoidable and need to be visible.

Outlook: Integrated Assessment Framework



ARCP-Project CAFEE – Climate change in agriculture and forestry: an integrated assessment of mitigation and adaptation measures in Austria

Change in DM Crop Yield with -20% precipitation in %



Change in SOC with -20% precipitation in %