Integrated Assessment of Climate Change Mitigation and Adaptation Impacts at Field and Farm level in the Austrian Mostviertel Region

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Global change at landscape level

drivers

climate change

CAP reforms & climate change policies

international market developments

land use & livestock change

response

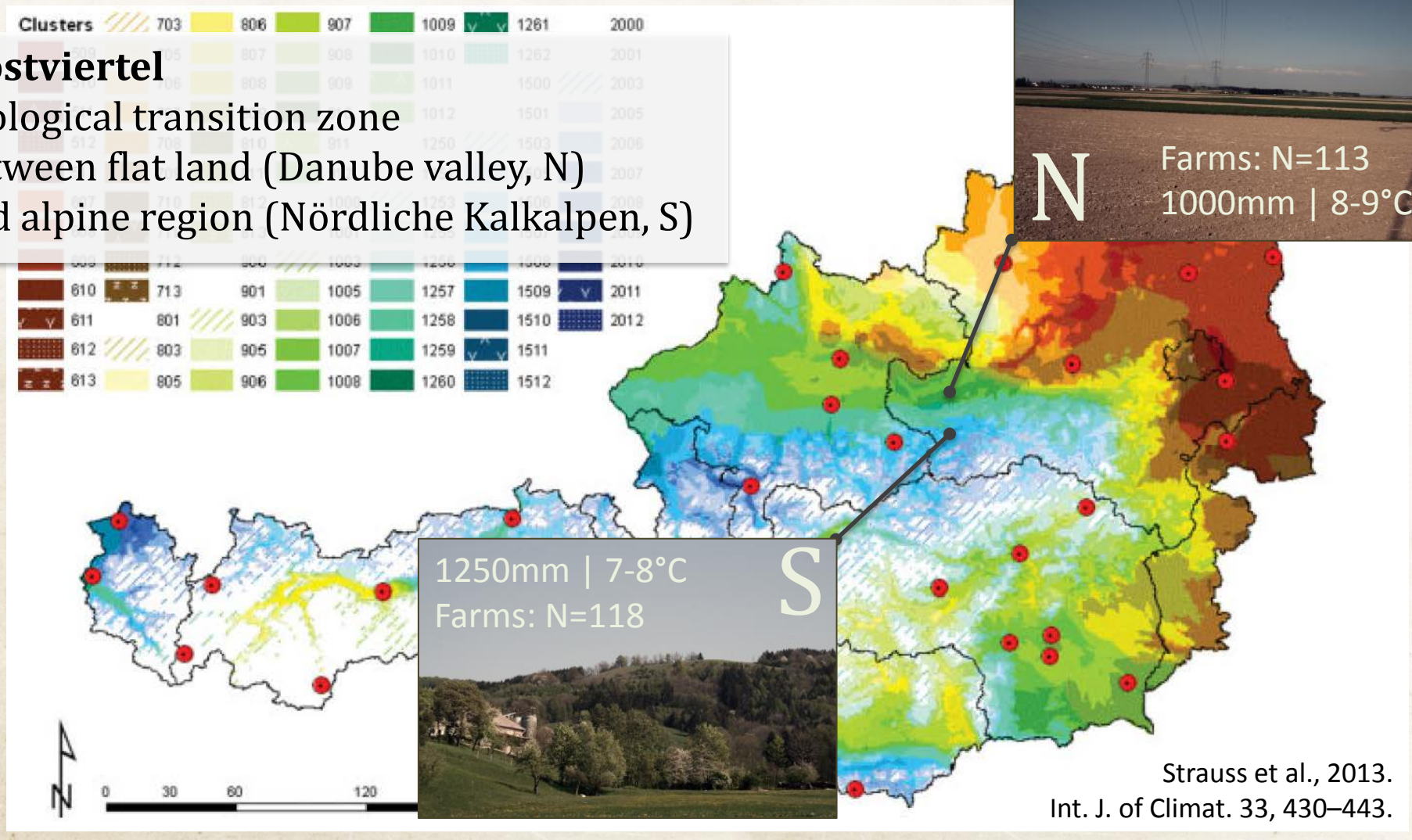
impacts

farm welfare

Abiotic environmental impacts

biodiversity

Case study landscape



Strauss et al., 2013.
Int. J. of Climat. 33, 430–443.

Methods and Data

Input

natural & socio-economic data

input and output prices
CAP
production functions
farm labor supply
livestock – herd sizes
observed land use
spatially explicit field data
landscape elements
climate scenarios
topography
soil characteristics

Models

CropRota[1]

EPIC[2]

CALDIS VÂTIS[4]

FAMOS[space][3]

Output

socio-economic & RD indicators

farm gross margin
public budget spending
farm labor demand
landscape diversity & appearance

agri-environmental indicators

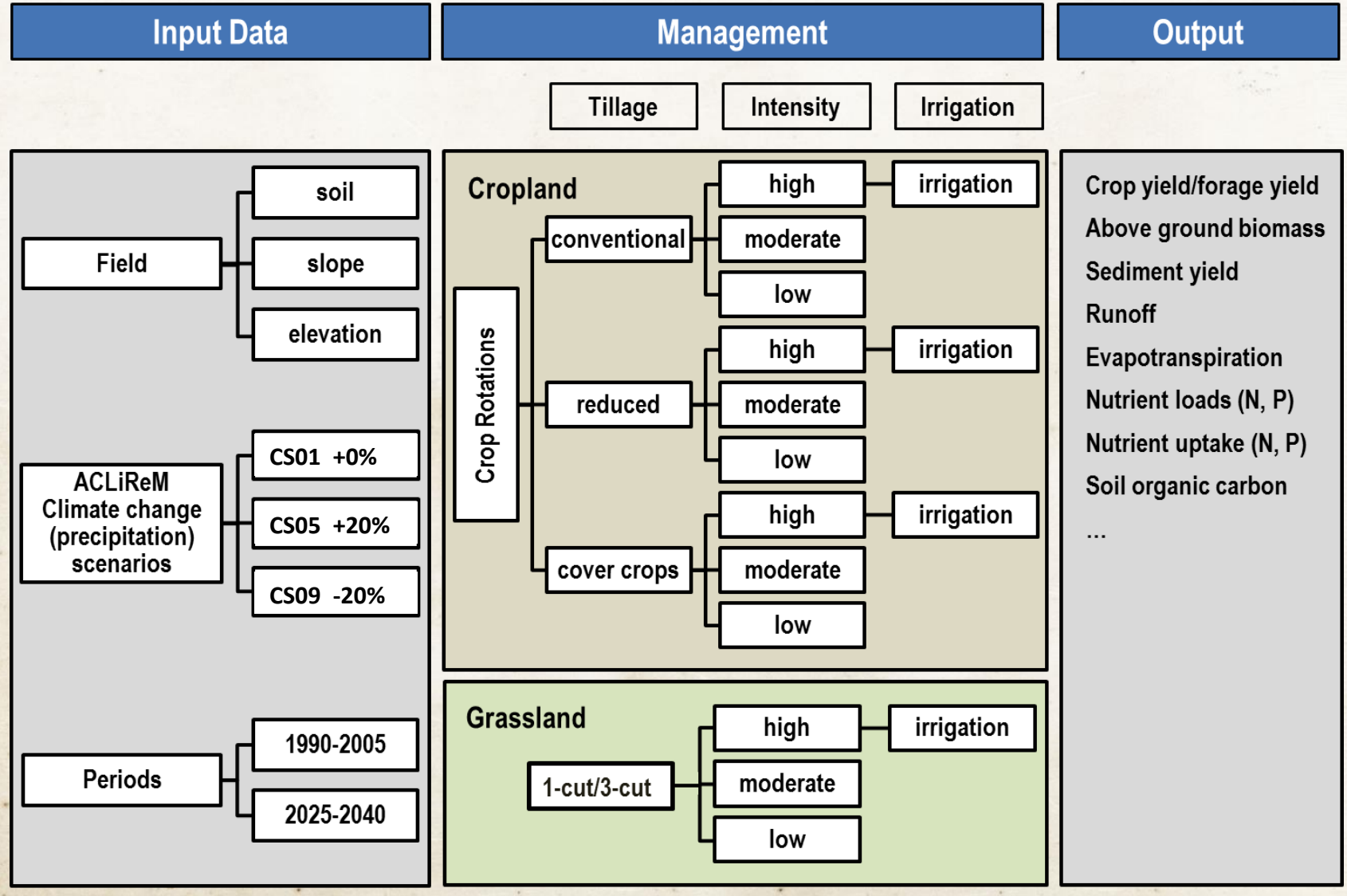
agric. & forestry land use change
biodiversity
SOC
soil sediment loss
N & P nutrient balances
GHG emissions

food production indicators

crop & livestock production

[1]Schönhart et al. (2011). Eur J Agron 34, 263-277.
[2]e.g. Izaurralde et al. (2006). Ecol Modell 192, 362-384.
[3]Schönhart et al. (2011). J Environ Plann Manage 54, 115-143.
[4]Georg Kindermann, BFW (see Kirchner et al., 2014). Ecol Econ (in press).

EPIC – model run settings

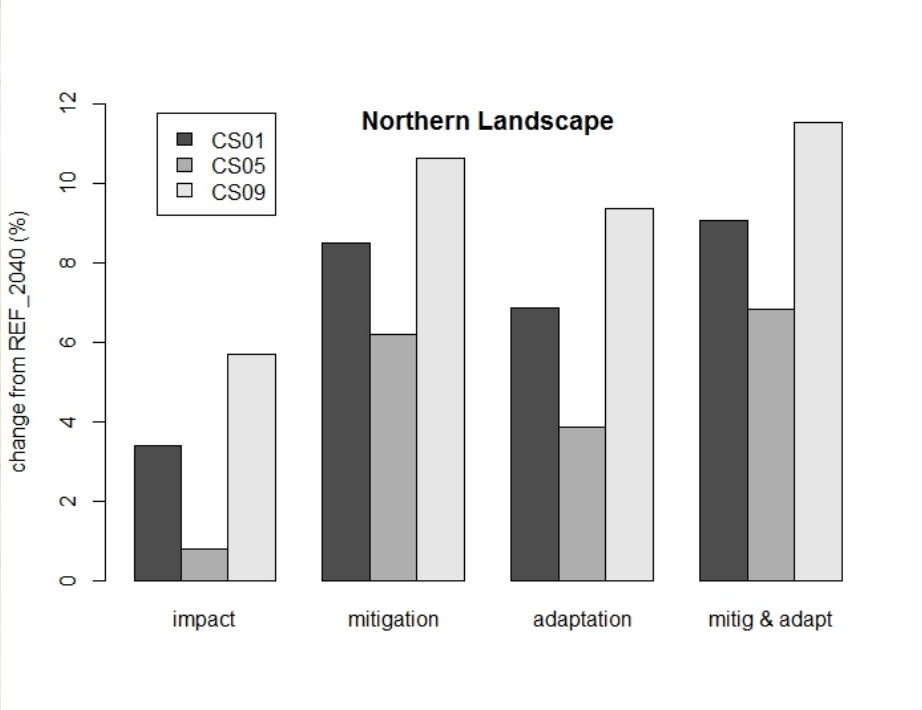


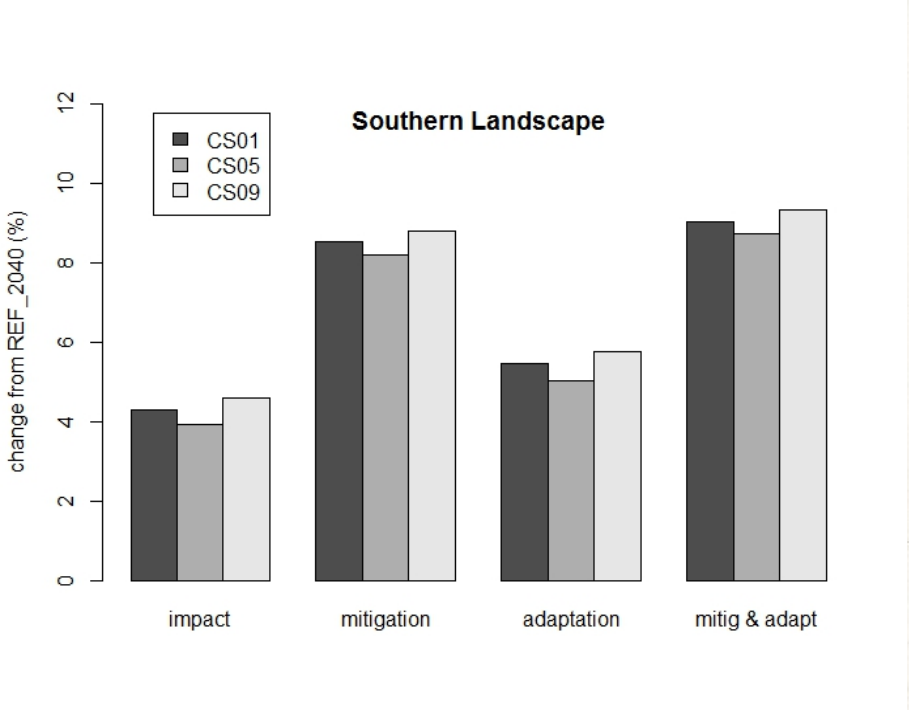
Impact, mitigation & adaptation scenarios

Name	CC	AEP	CAP reform	Mitigation policies	Adaptation policies
REF_2008	No	No	No		
REF_2040	No	No	no dairy quota; no livestock premiums; regional farm payment; greening; LFA payments from 2008		
CS[CC]_i	Yes	No	like REF_2040		
CS[CC]_m	Yes	No	like REF_2040	energy crops on set aside; subsidies for landsc. elements, SRF, afforestation, cover crops, min. tillage and extensive land use	
CS[CC]_a	Yes	No	like REF_2040		no greening, subsidies for maintenance of steep slope grass land and irrigation
CS[CC]_m&a	Yes	No	like REF_2040	like CS[CC]_m	like CS[CC]_a

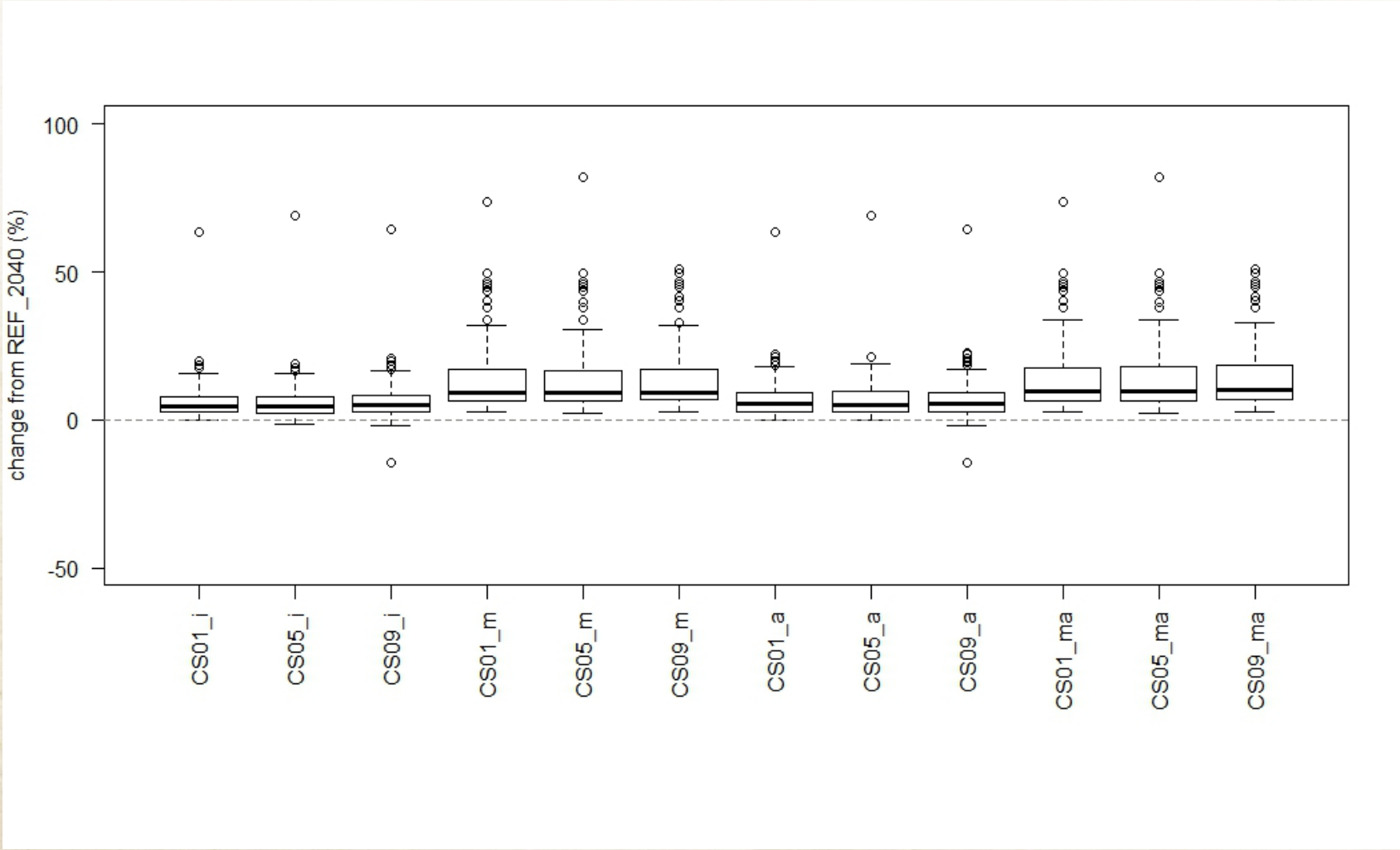
Climate Change [CC] Scenario Name	Climate change in 2040	
	Δ temperature (°C)	Δ precipitation (%)
CS01	+ 1.6	0%
CS05	+ 1.6	+20%
CS09	+ 1.6	-20%

Results – average changes in farm gross margins
1990-2005/2025-2040





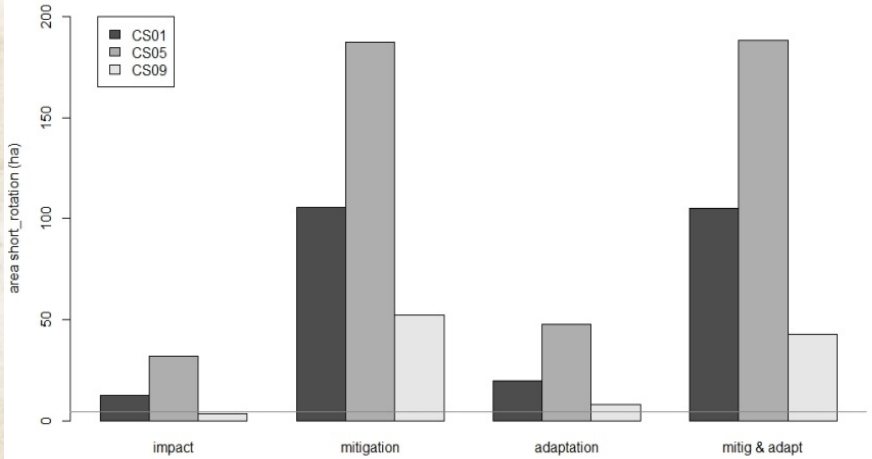
Results – changes in farm gross margins
1990-2005/2025-2040



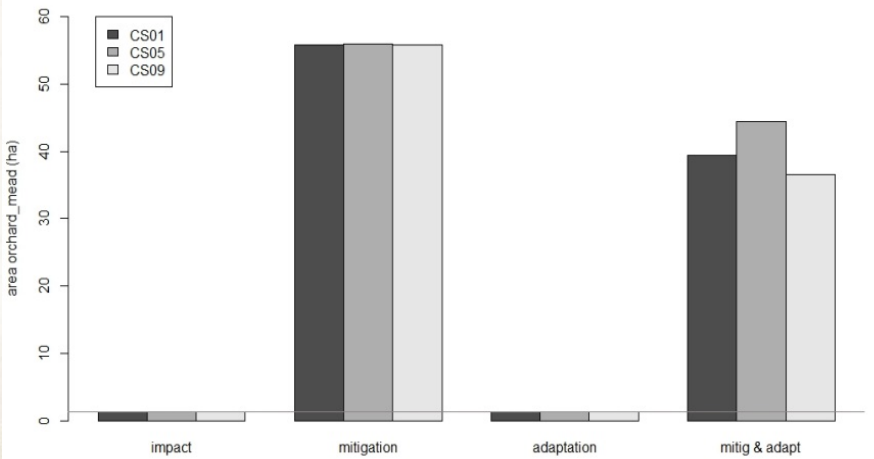
Results – land use change

1990-2005/2025-2040; northern region

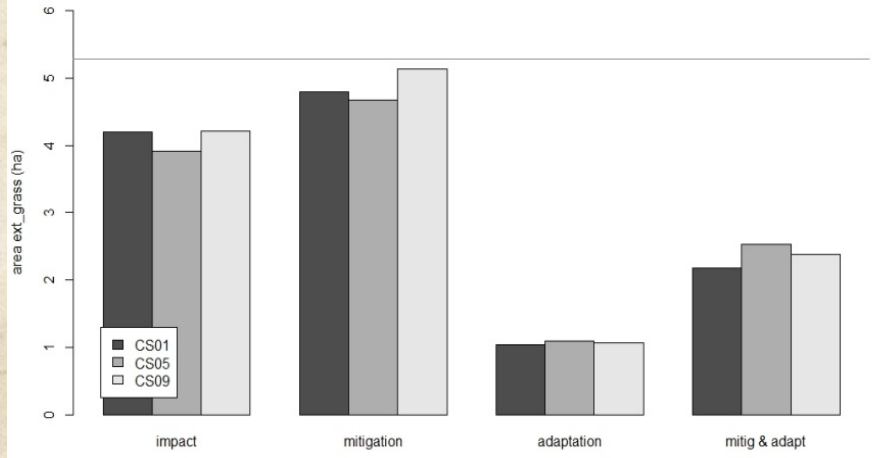
Short rotation forestry



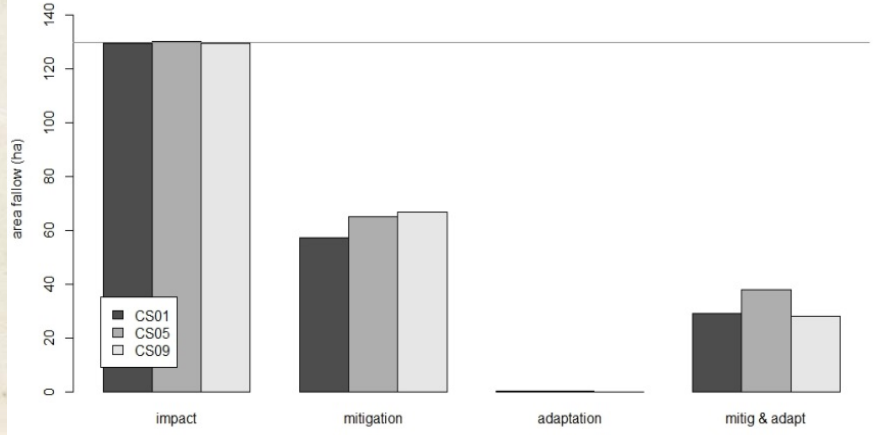
Orchard meadows



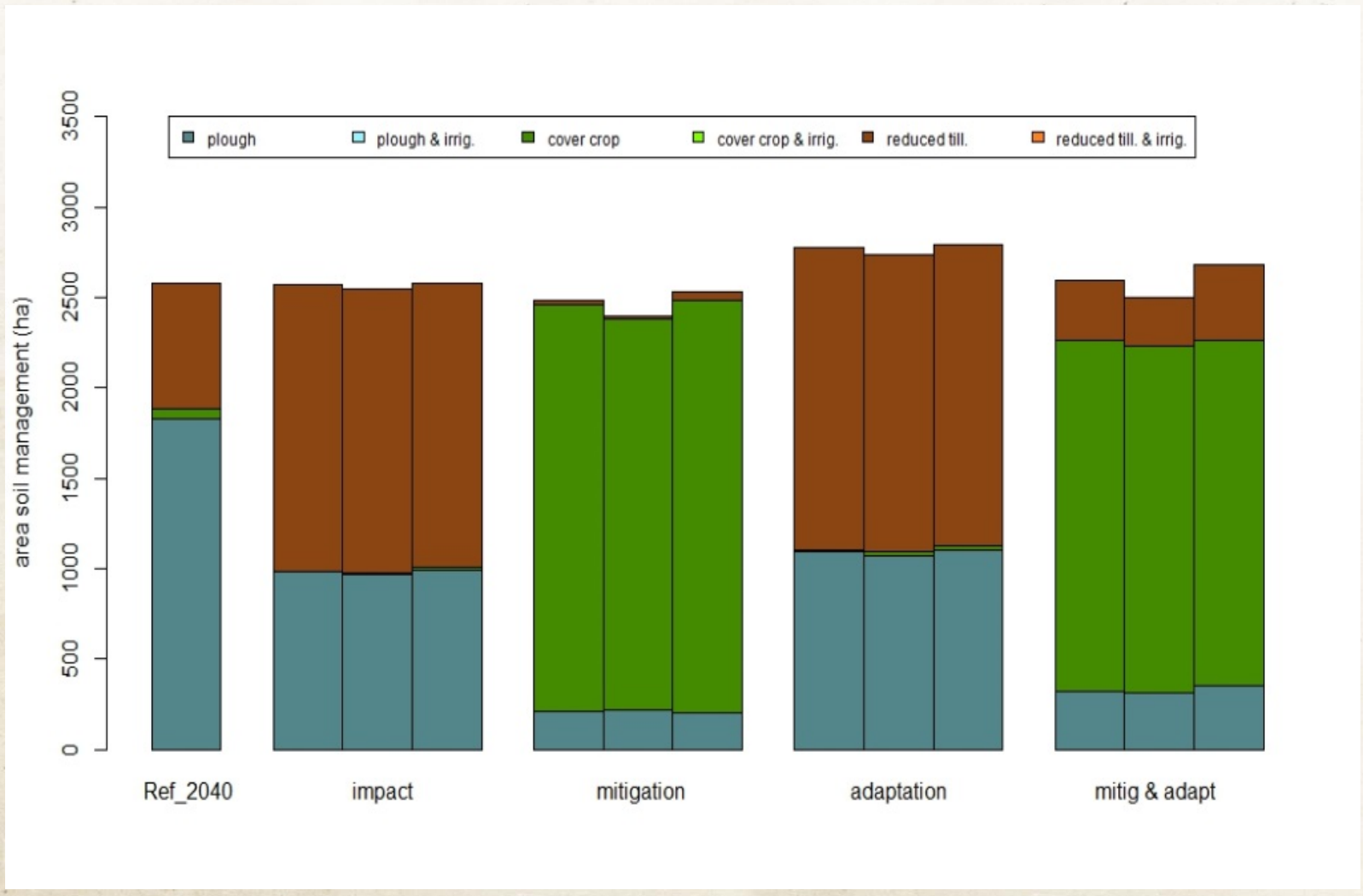
Extensive grassland



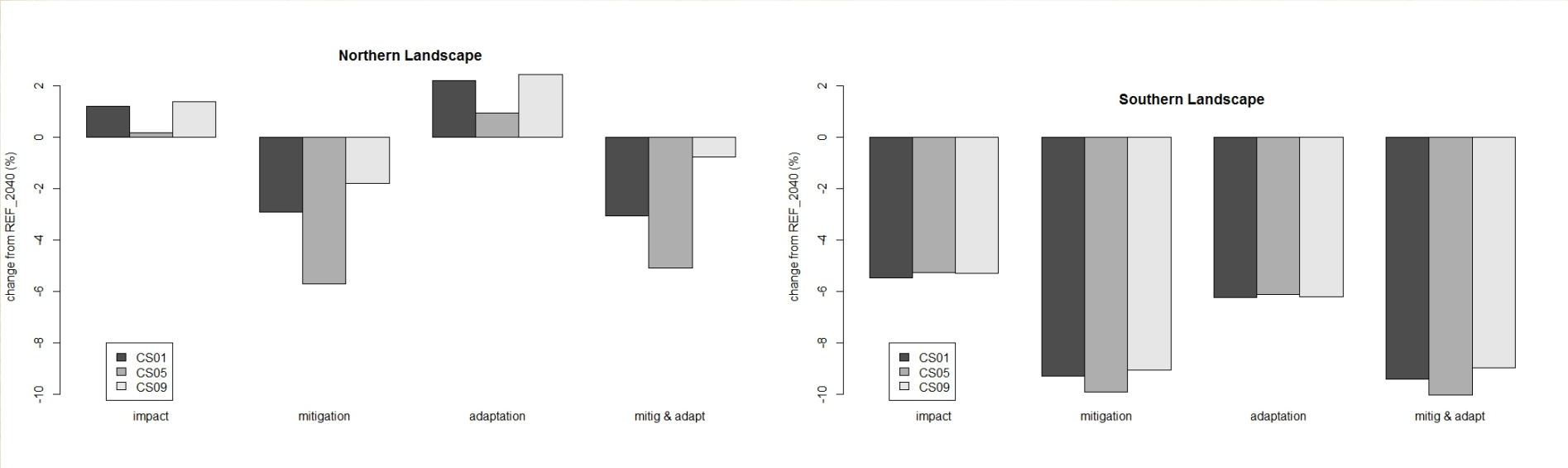
Fallow land



Results – soil management
1990-2005/2025-2040; northern region

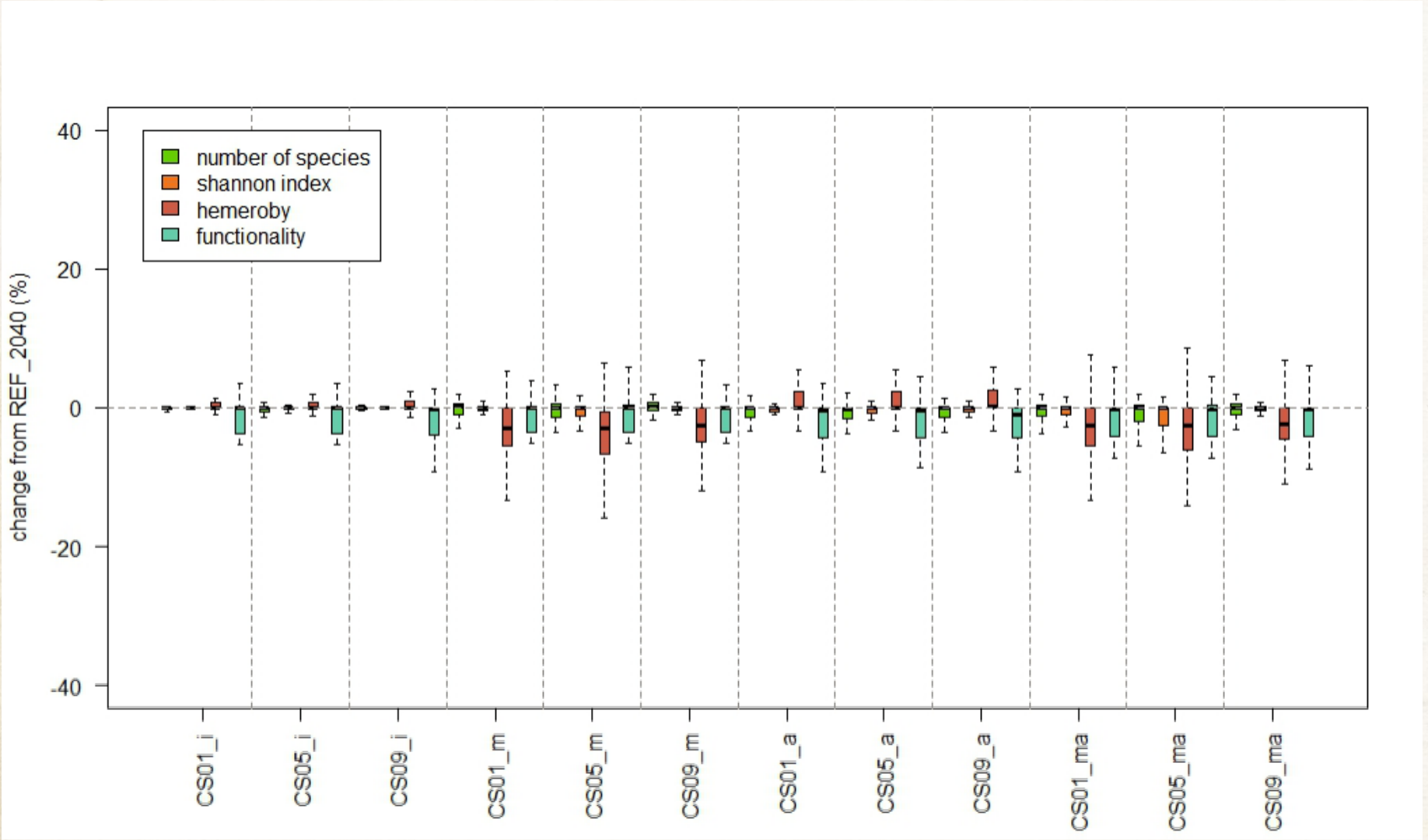


Results – changes in GHG emissions
1990-2005/2025-2040



Results - farm land biodiversity indicators

1990-2005/2025-2040



Discussion on results

- Both mitigation and adaptation increase farm incomes eventually at the cost of public budgets
- Adaptation policies that increase flexibility can come at environmental costs (trade-off between production and environmental protection)
- Diverse climate change impact among regions and farms despite proximity of both case study landscapes
- Differences among climate scenarios depends on the region and can be small compared to the policy impacts
- Increasing productivity on average increases intensification pressures
  - permanent grassland, extensive land use and landscape elements may be threatened
  - future AEP design must take changing productivity into account

Discussion on methods

- High spatial resolution of integrated assessment framework
- Abiotic and biotic environmental indicators
- Rich in crop and livestock management variants
- Detailed representation of agricultural policies

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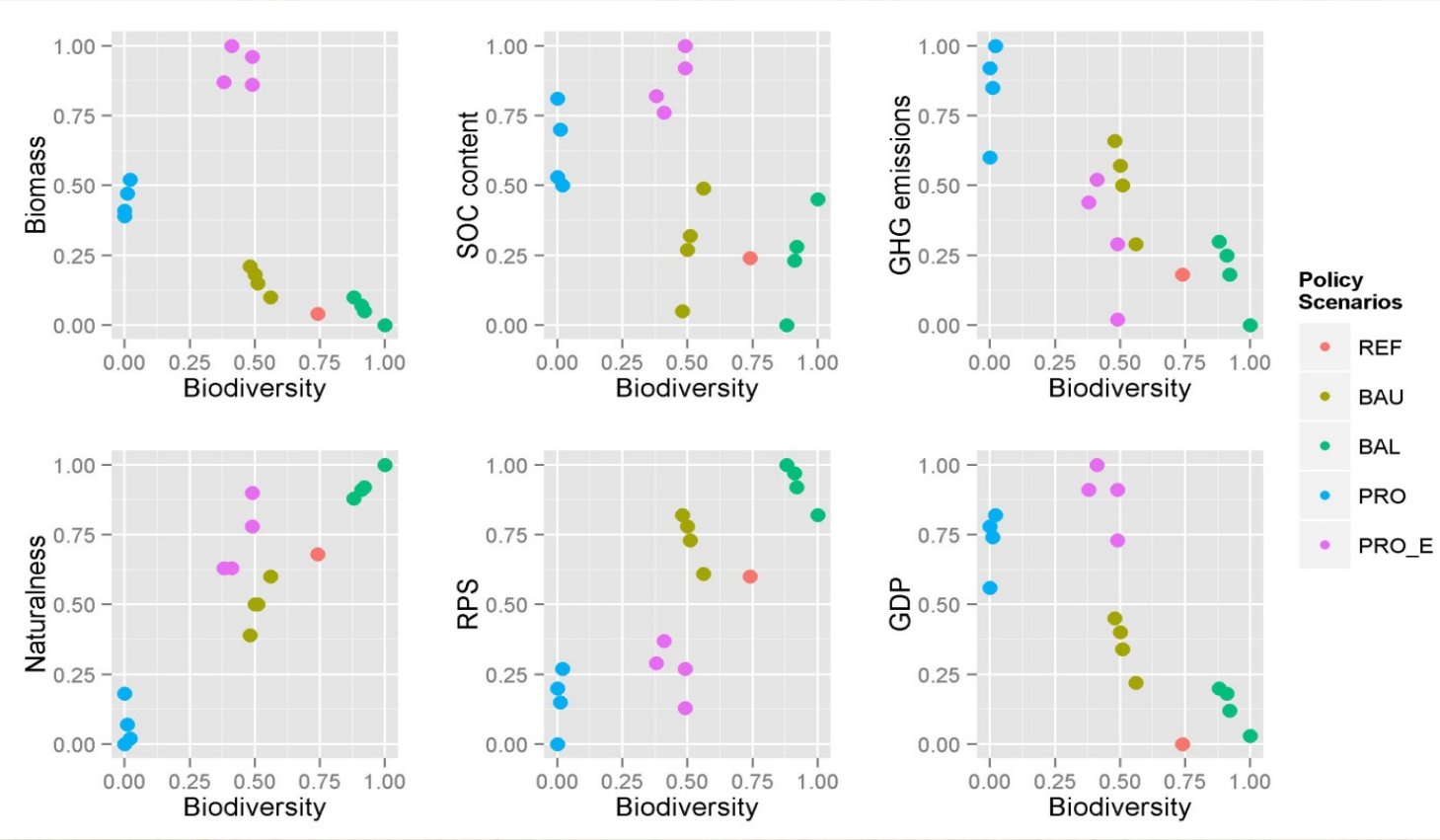
- Covers two case study landscapes only
- No interactions among farms so far
- High data and computational demand
- Assumption on max. gross margin

Outlook

Analysis of trade-offs and synergies



Kirchner et al., 2014. Ecological Economics (in press).

Outlook

Landscape visualization

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