Integrated Assessment of Climate Change Mitigation and Adaptation Impacts at Landscape level: Mostviertel, Austria

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Climate-change impacts on farming systems in the next decades — why worry when you have CAP?
A FACCE MACSUR workshop for policymakers
Wednesday 6th of May 2015, Brussels

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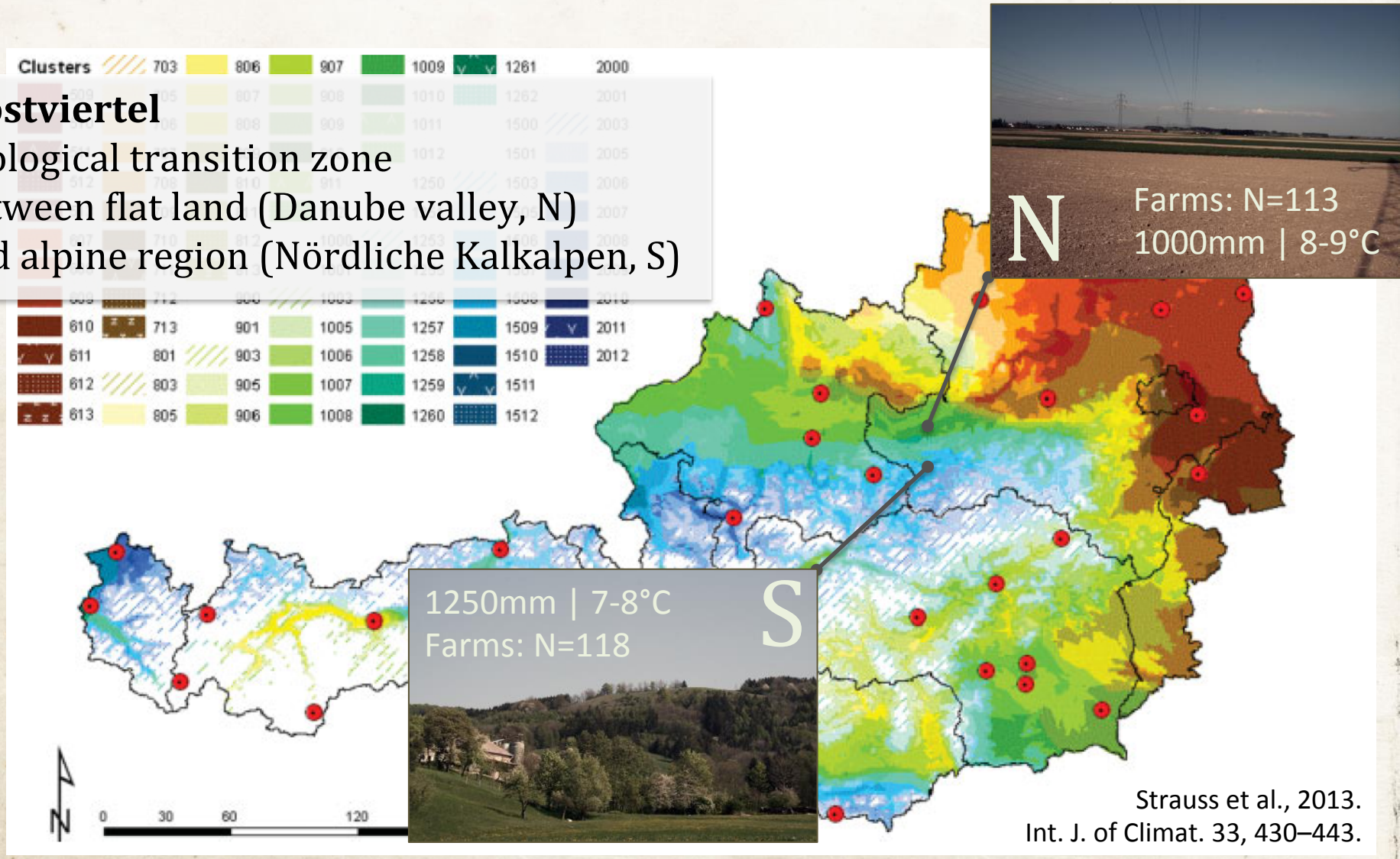
Case study landscape



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]

Crop rotations

EPIC[2]

Crop yields

CALDIS VÂTIS[4]

Timber yields

FAMOS[space][3]

Max. gross margin

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).

Impact, mitigation & adaptation scenarios

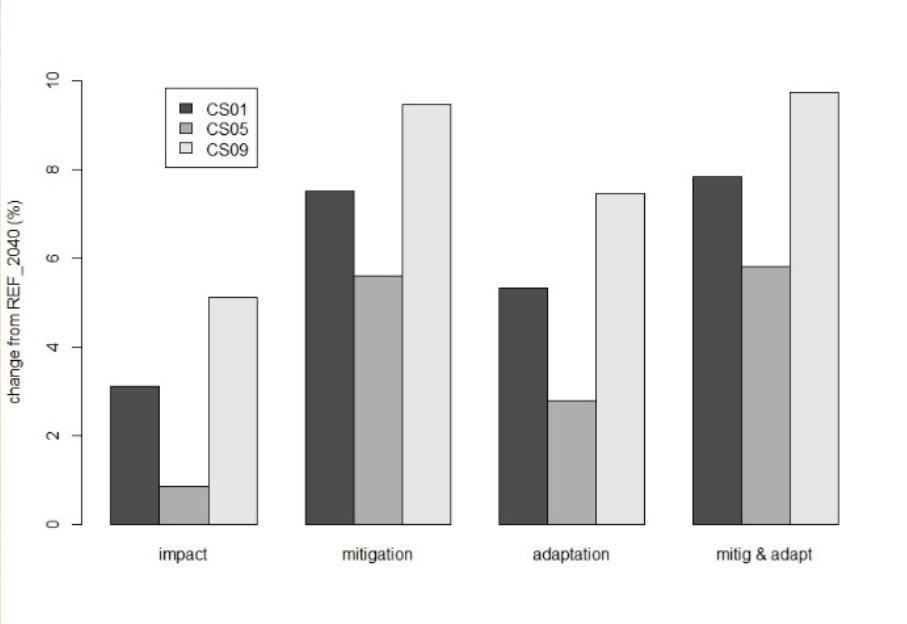
Name	CC*	AEP*	CAP reform	Mitigation policies	Adaptation policies
REF_2040	No	No	no dairy quota; no livestock premiums; regional farm payment; greening; LFA payments from 2008		
CS[CC]_i	Yes	No	like REF_2040		
CS[CC]_m	Yes	No	like REF_2040	energy crops on set aside; subsidies for: landsc. elements, SRF, 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]_ma	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	+ 1.5	0%
CS05	+ 1.5	+20%
CS09	+ 1.5	-20%

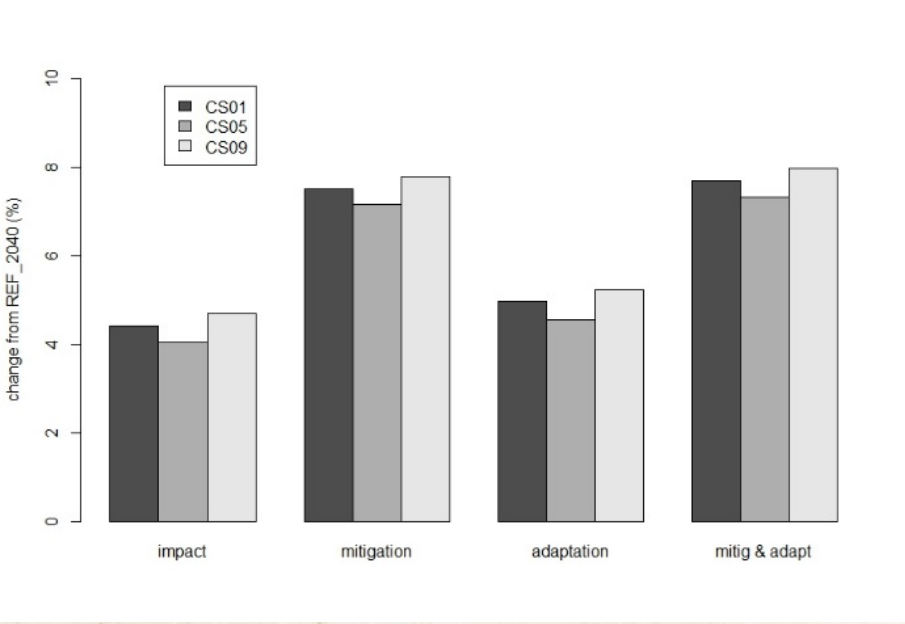
* CC…climate change, AEP…agri-environmental program

Results – changes in average aggregated farm gross margins from climate change and policies

Northern landscape



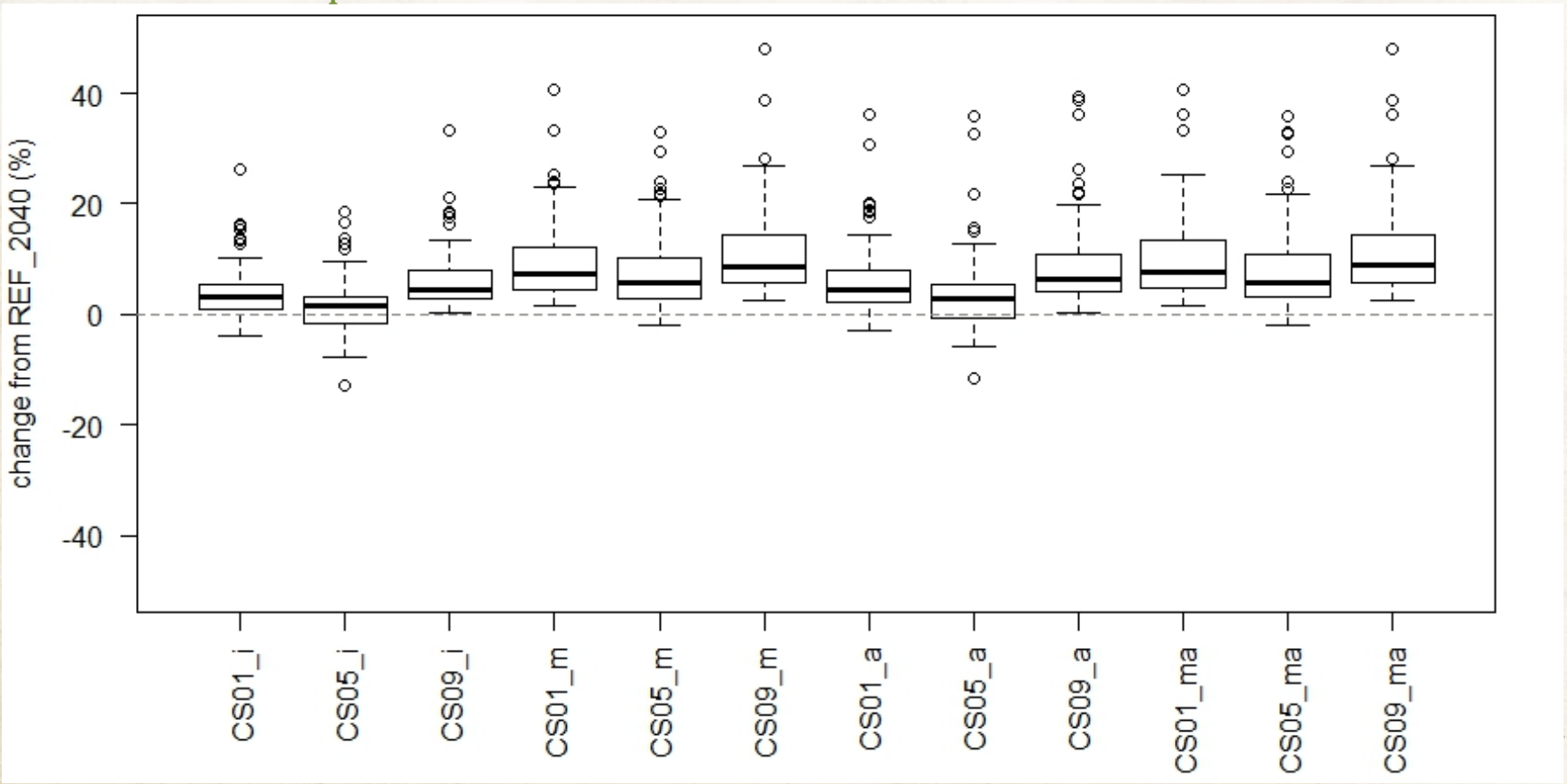
Southern landscape



Gross margin: + product sales (plant, livestock) + subsidies + annuities for long-term investment
- variable costs (machinery, inputs and services, off-farm labor)

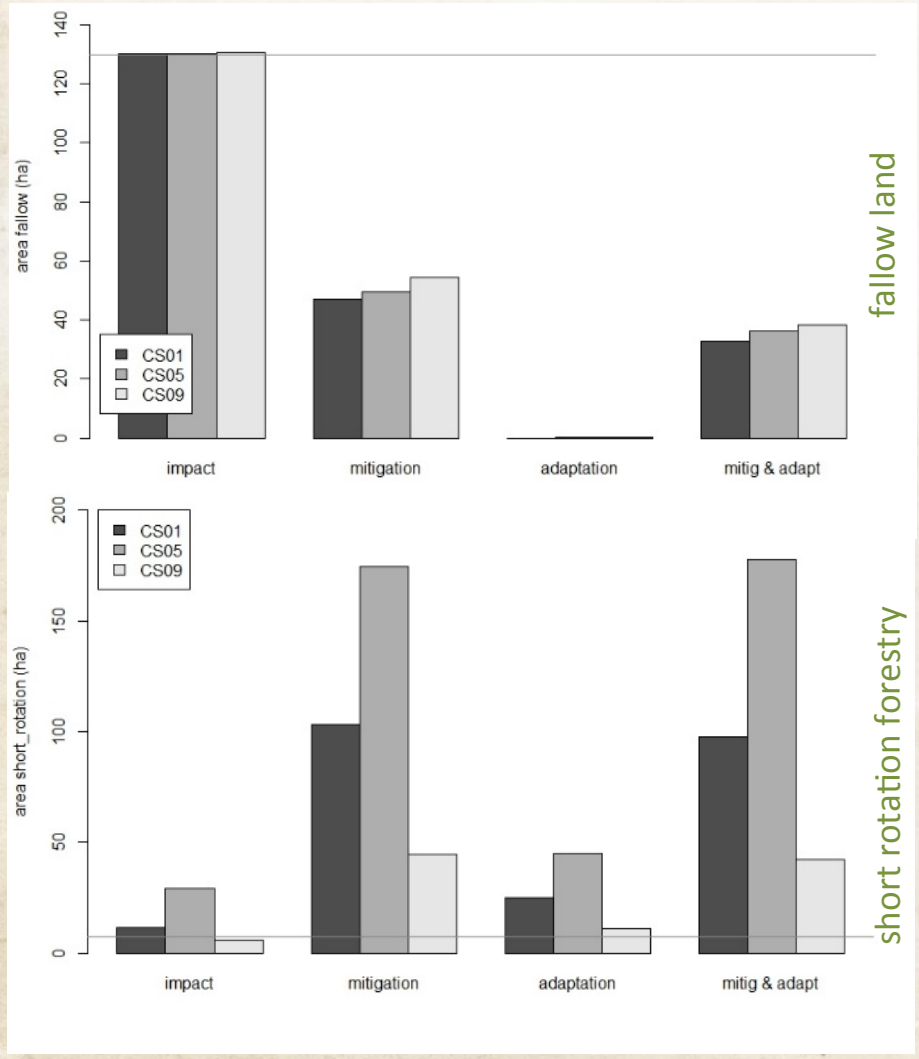
Results – changes in farm gross margins from climate change and policies

Northern landscape

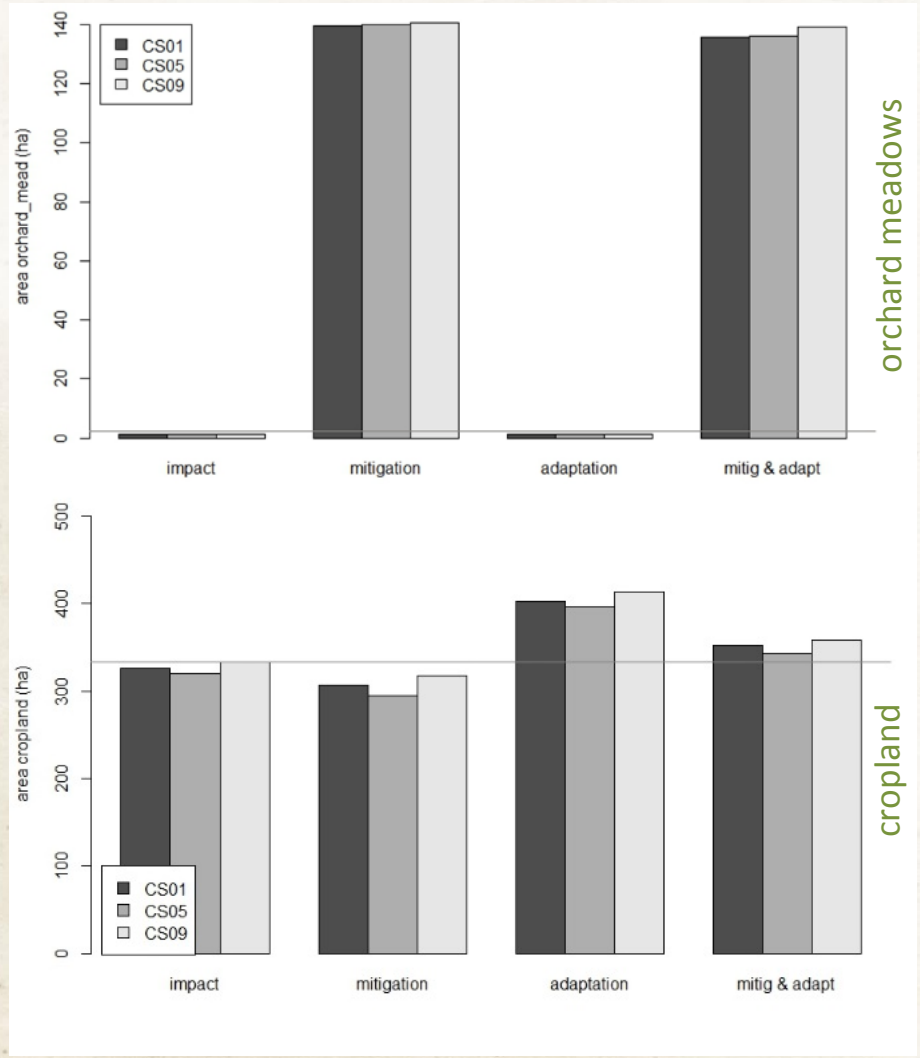


Results – land use change from climate change and policies

Northern landscape

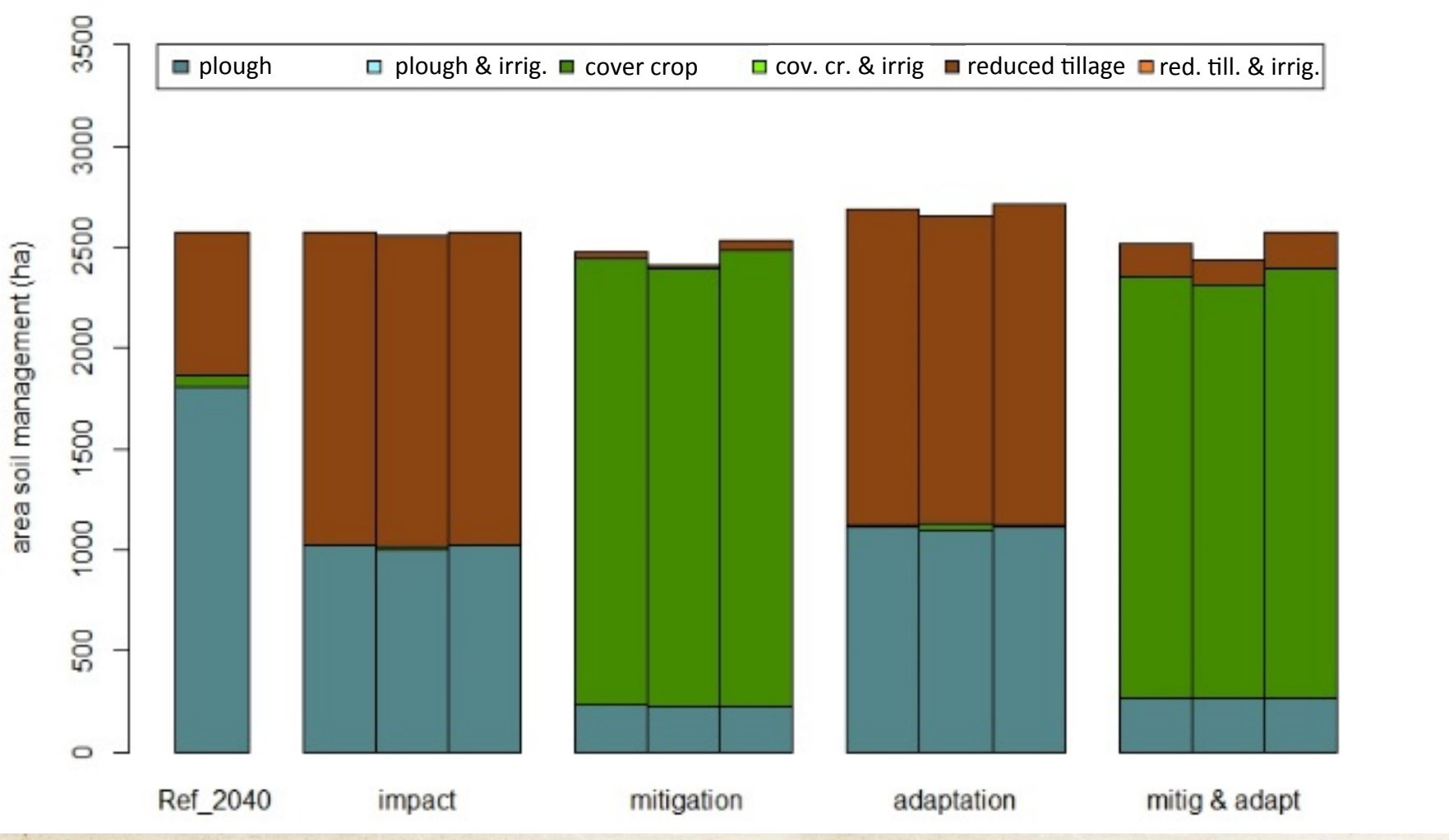


Southern landscape



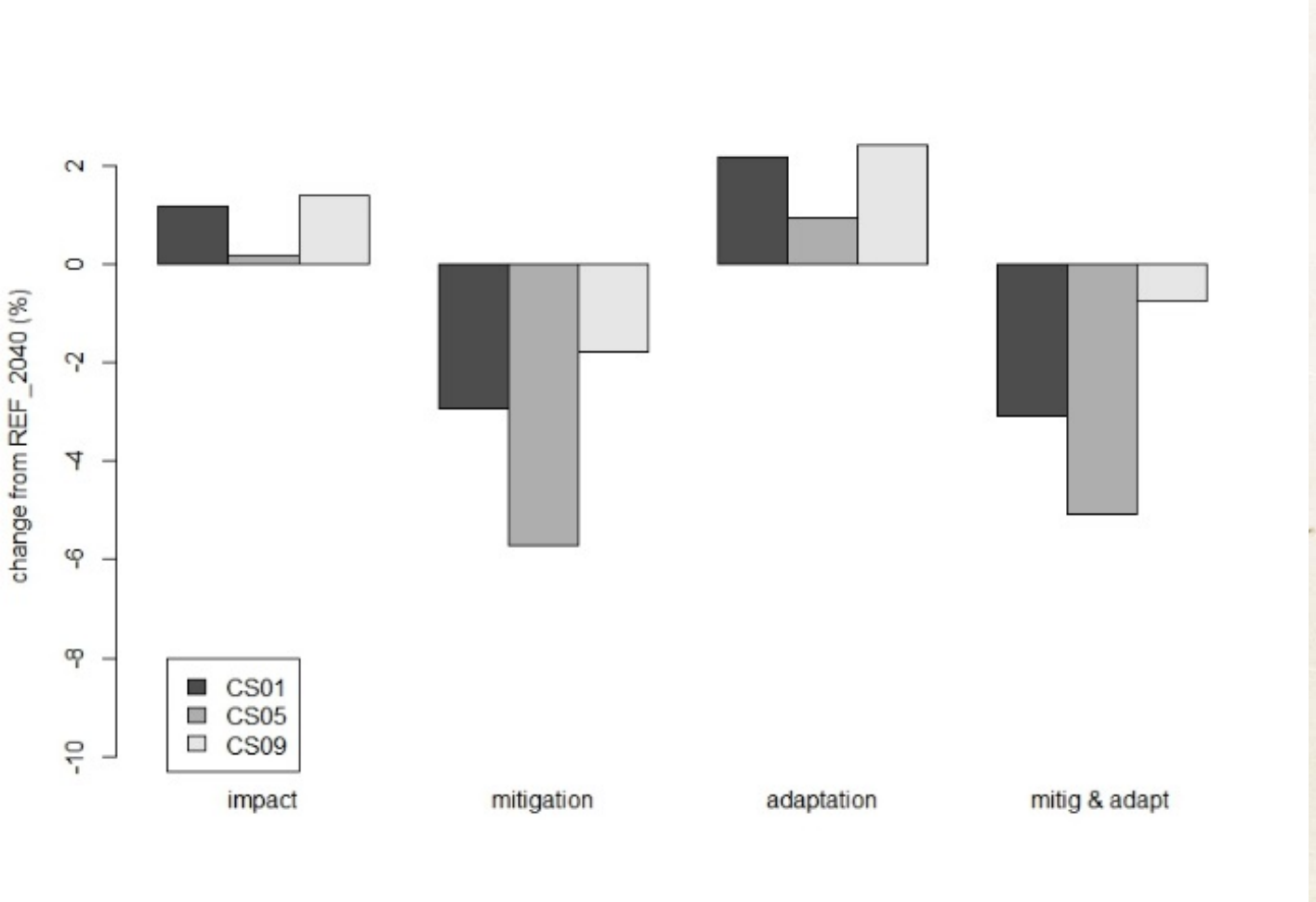
Results – soil management

Northern landscape



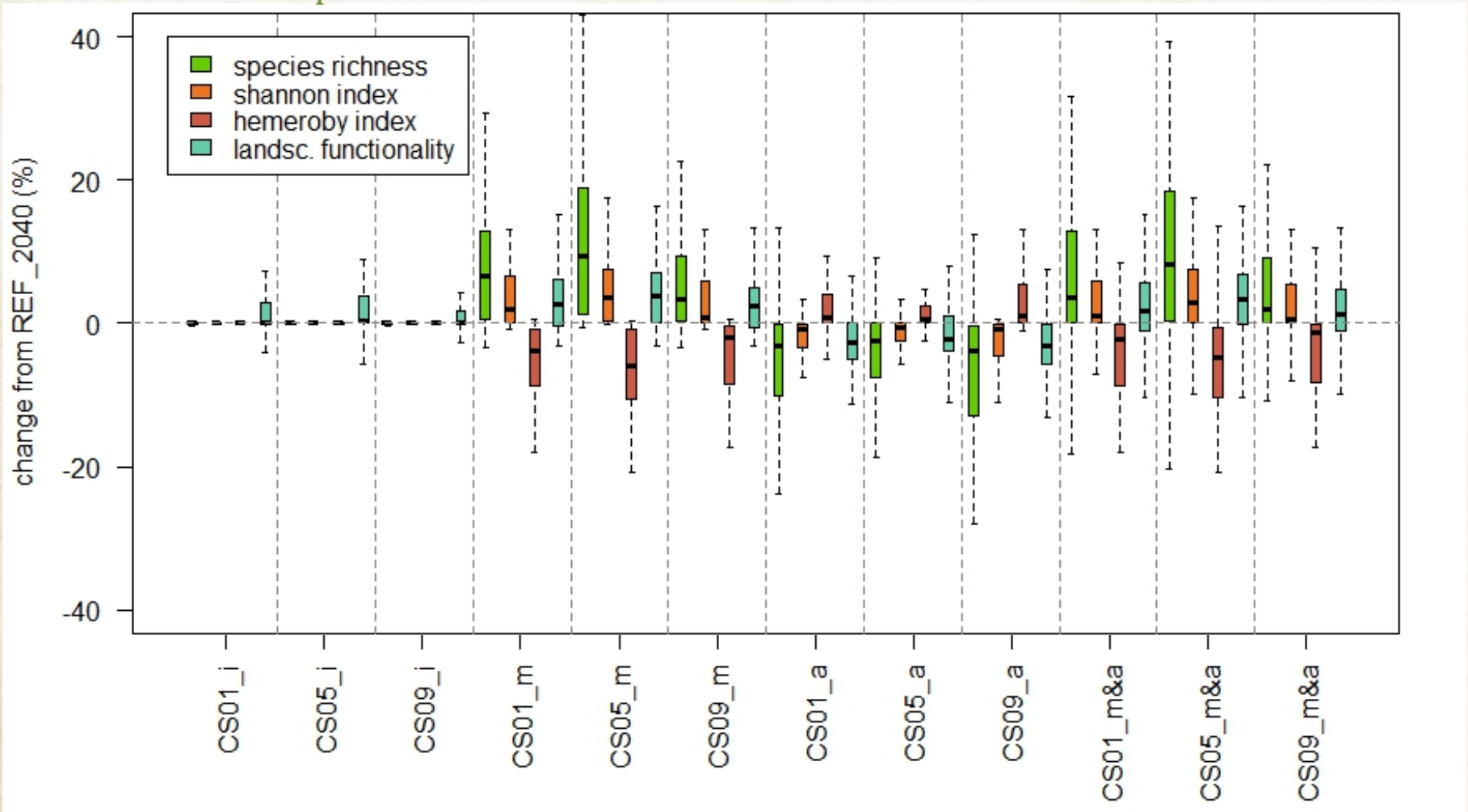
Results – changes in GHG emissions from climate change and policies

Northern landscape



Results - farm land biodiversity indicators from climate change and policies

Northern landscape



Discussion

- Increasing productivity on average in both landscapes
  - In line with some of the literature, but not all – impacts on grassland more uncertain than on arable crops
  - Extreme weather events partly considered, not so changing pests & diseases
- Increasing farm gross margins on average from assumed mitigation and adaptation policies
  - Mitigation policy: environmental protection vs. public money and ag. production
  - Flexibility from adaptation shows trade-offs between ag. production and env.
  - Leackage and international market impacts not considered
- Adaptation driven by available options, awareness and attitudes
- Location determines impacts
  - Heterogeneous climate change impacts among regions and farms
  - Not only latitude but altitude to be considered as well in impact studies

Conclusions

- Increasing productivity can increase intensification pressures
  - Threatened permanent (extensive) grasslands and landscape elements, but
  - subject to resource constraints, costs and prices and
  - future production potential to increase global food supply
  - Future RDP and environmental policy design (e.g. WFD) should take changing productivity into account
- Heterogeneity matters at farm and regional level
  - Changing relative competitiveness of farms
- Future research: analyze uncertainties

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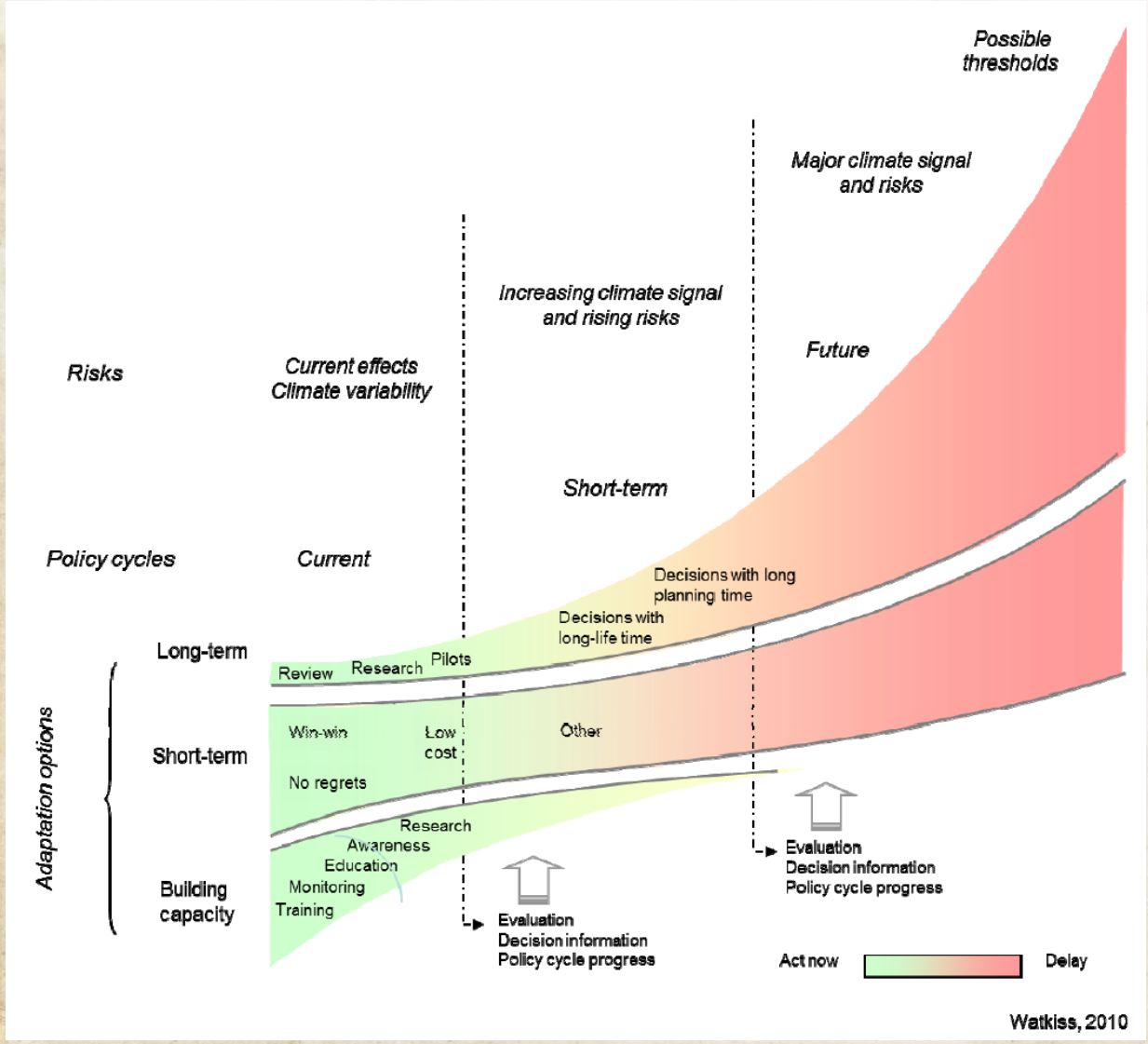
Adaptation pathway Wattkiss et al. 2010



What do we have to know and what to do **when**?

Global change at landscape level

drivers

climate change

CAP reforms & climate change policies

international market developments

3 weeks

-70% land use & livestock management

response

impacts

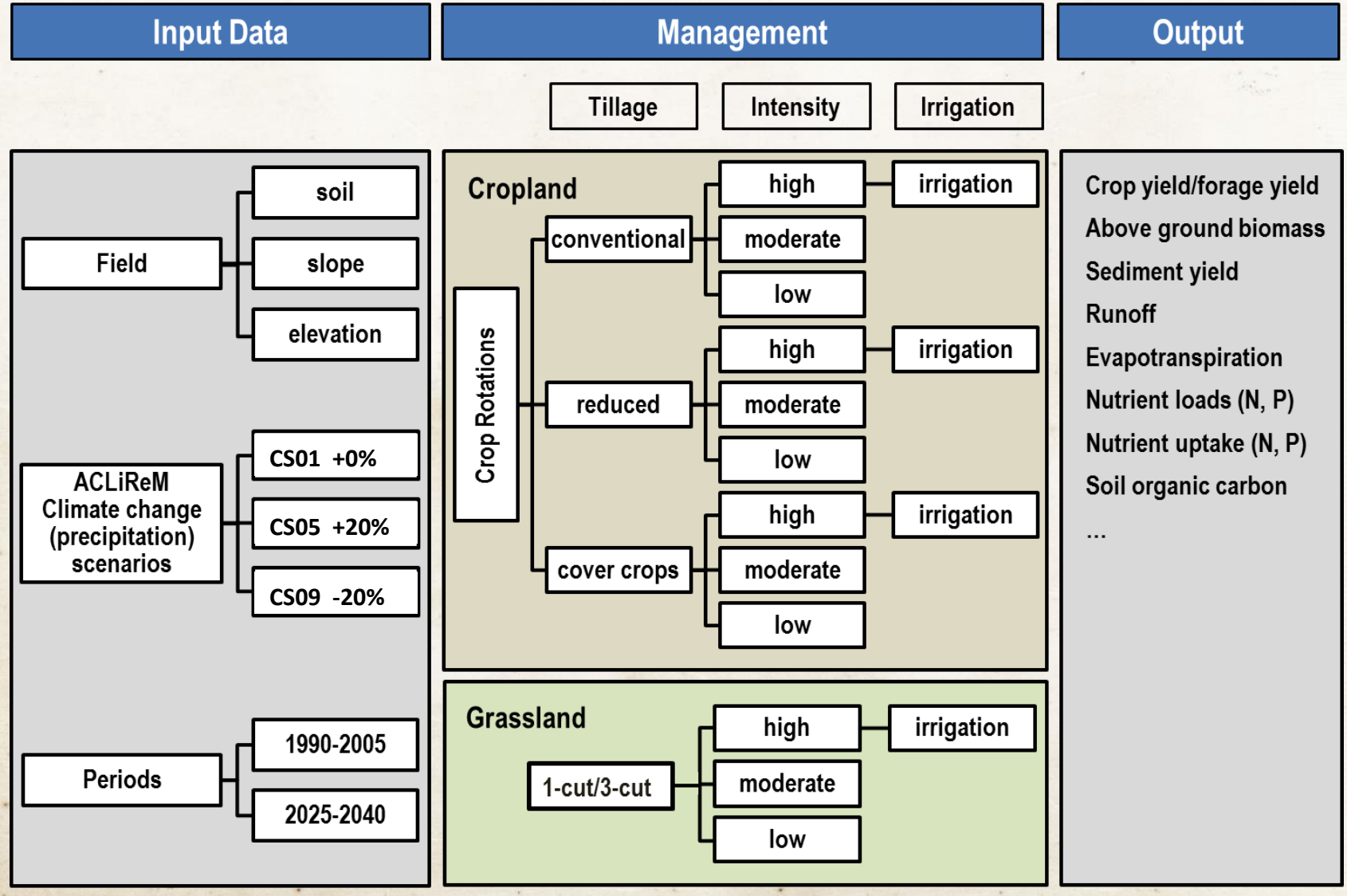
farm welfare

abiotic environmental impacts

biodiversity

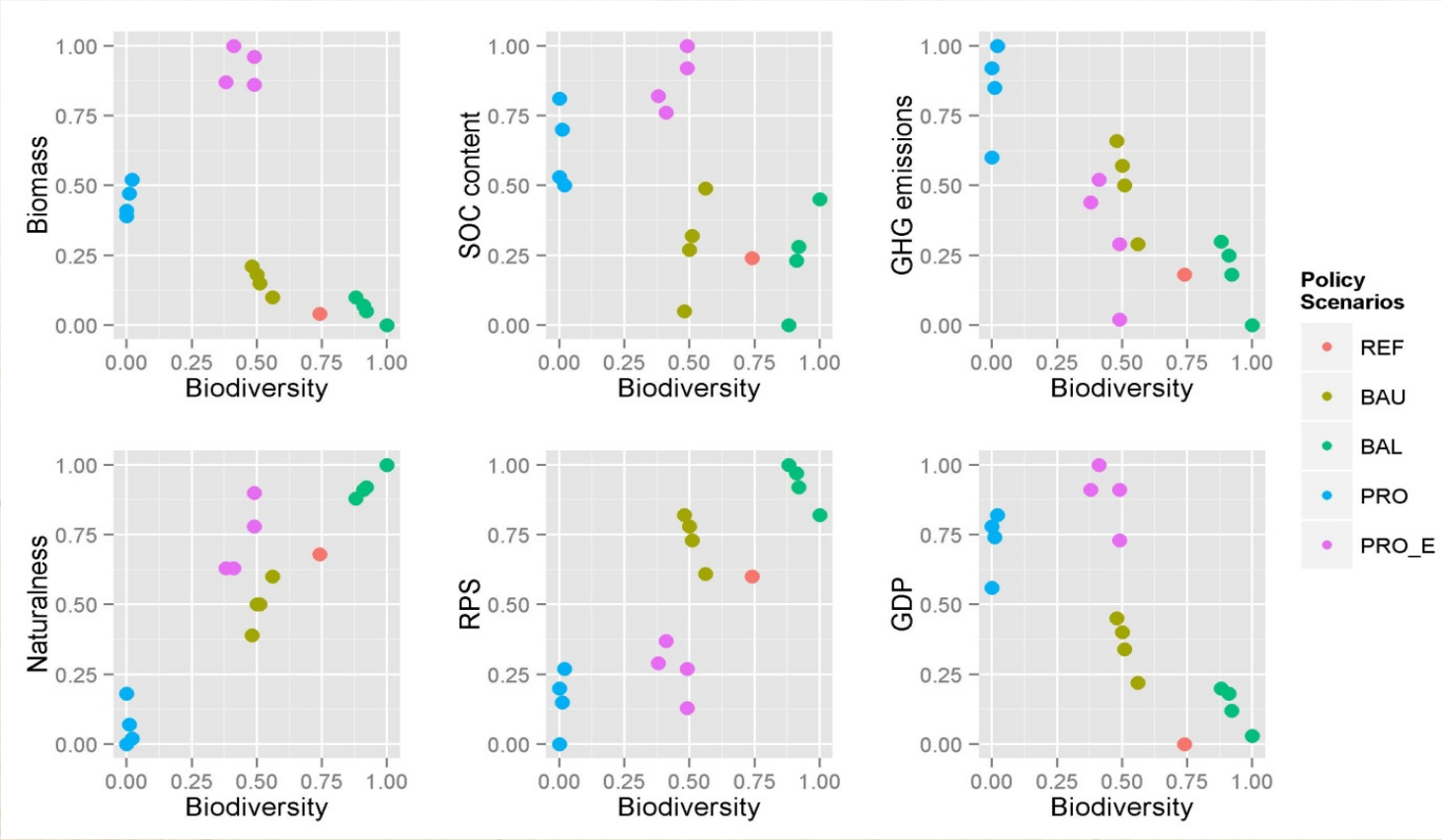
landscape appearance

EPIC – model run settings



Outlook

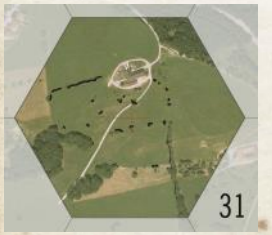
Analysis of trade-offs and synergies



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

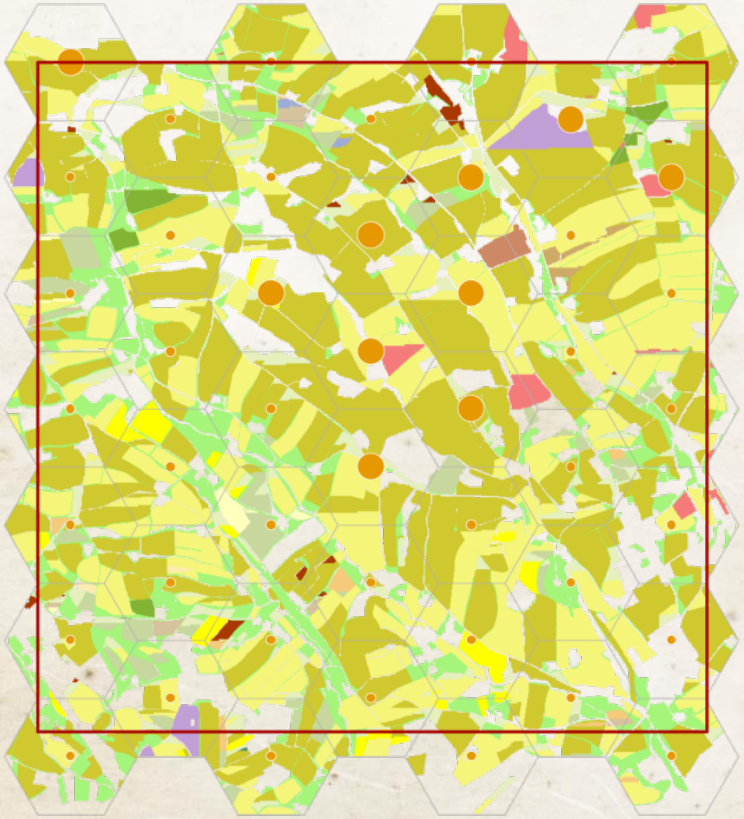
Outlook

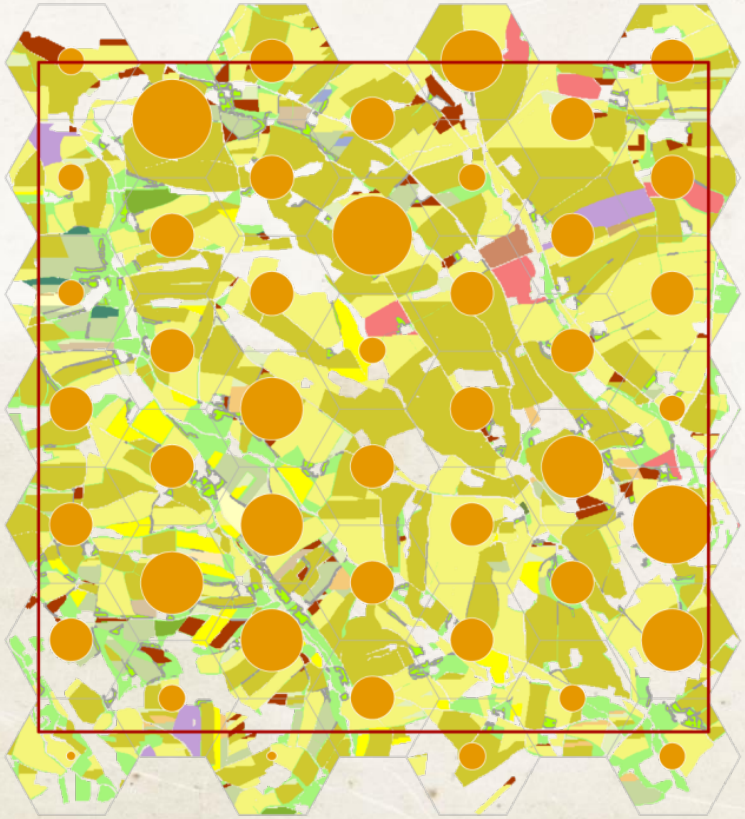
Landscape visualization



Results – ACVV* indicator for landscape appearance

Northern landscape – REF_2040





Northern landscape – CS09_m

* Agricultural crops and vegetables value