

From global threat to local action

– considering multiple dimensions of regionality for successful climate change adaptation



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dpa (mdr)

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IALE 2022 European Landscape Ecology Congress
MAKING THE FUTURE, LEARNING FROM THE PAST

Agricultural growing conditions over Germany (base map)

Climate and climate change effects



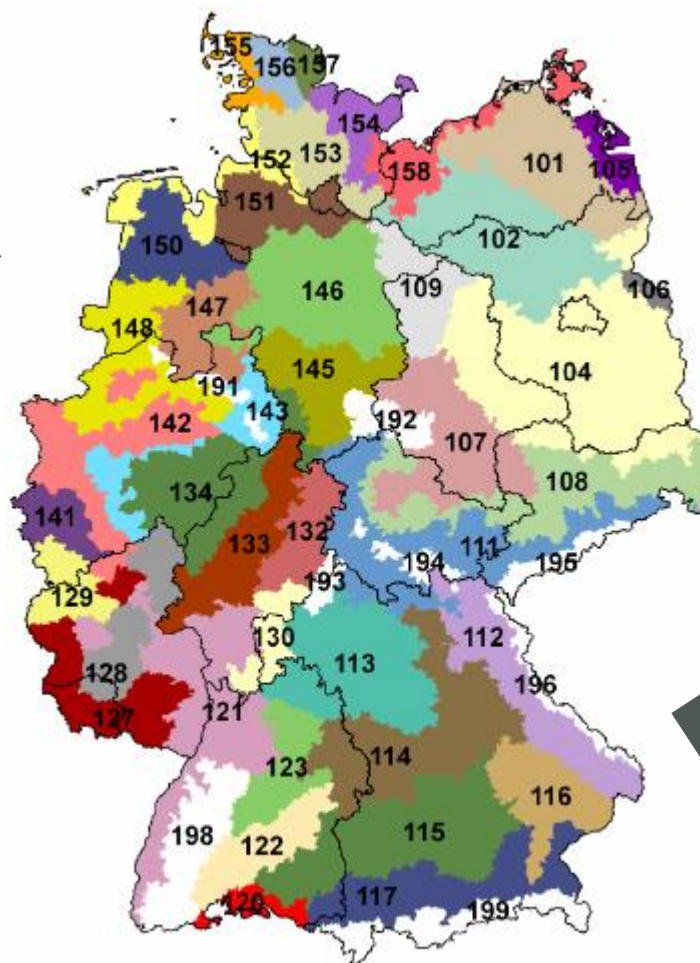
Occurrence of pests and diseases



Cropping options



Farm structures/ Economy



Soil-Climate-Units = Lead soil type + Soil value number + Temperatur + Precipitation



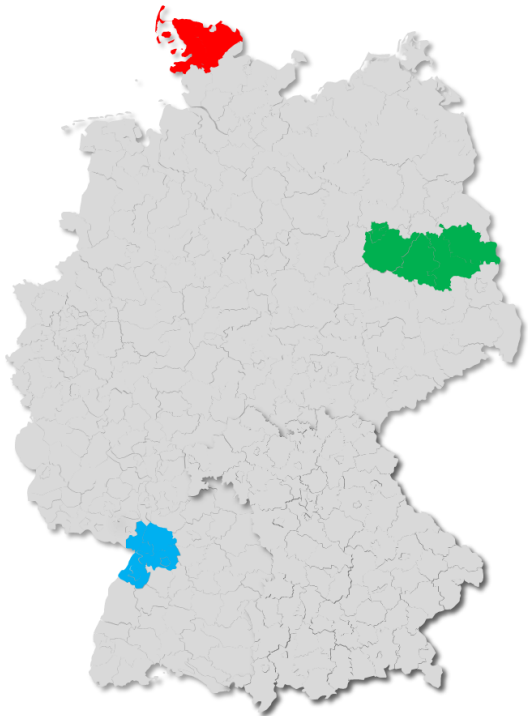
OptaKlim

Gefördert durch:



Bundesministerium
für Ernährung
und Landwirtschaft

aufgrund eines Beschlusses
des Deutschen Bundestages



- Optimisation of cropping strategies and practices for climate adaptation **(OptaKlim)**
- Duration: 2018 – 2022, Funding: BLE (German Federal Ministry of Food and Agriculture)
- **Objectives:**
 - Quantification of the efficiency of agricultural adaptation measures at the regional scale
 - Model based multi-criterial evaluation of agricultural adaptation measures
 - Trade off analyses and optimisation advices
 - Web based information / decision support tool

Data use and co-design at three focus regions over Germany



Which **effects** of climate change are observed already in the region?

How will **climate change** in the next decades?

Which **adaptation strategies** exist already? How do they work?



Investigation of **climate change scenarios** on:

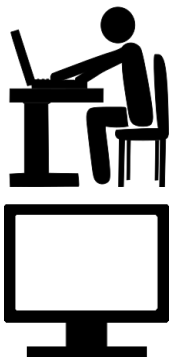
incidence of pests, crop protection strategies, yield and crop choice



Identification of **regional problem issues** and determination of regional **climate adaptation strategies**

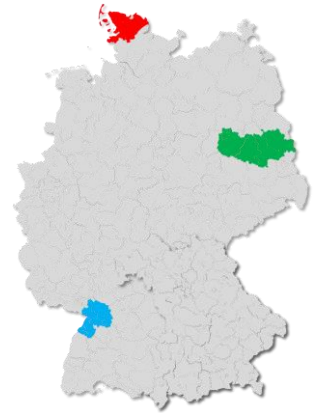
Results of farmers vote on adaptation strategies:

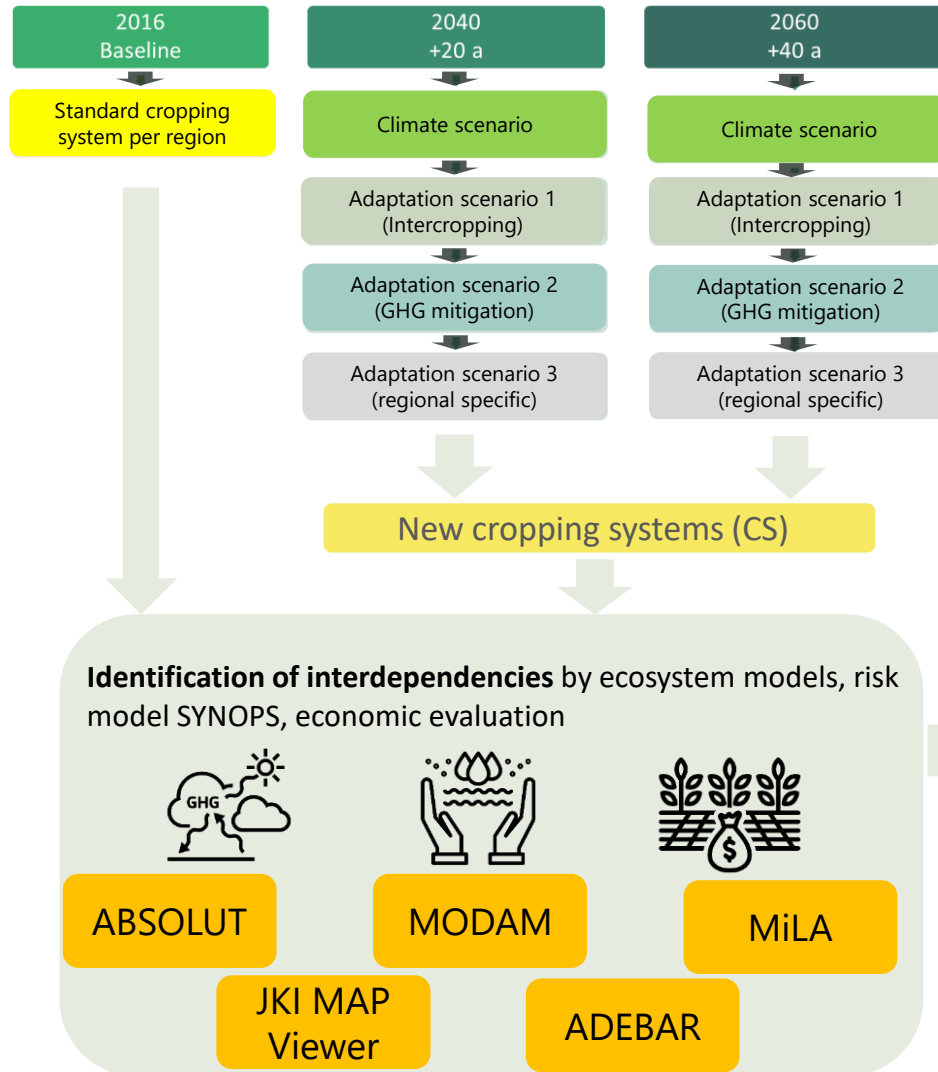
1. reduced tillage
2. intercropping/undersown crops
3. East: improvement of water efficiency
3. North: improvement soil biological activity
3. Southwest: diversification



Interdisciplinary analysis of existing practices and adaptation strategies

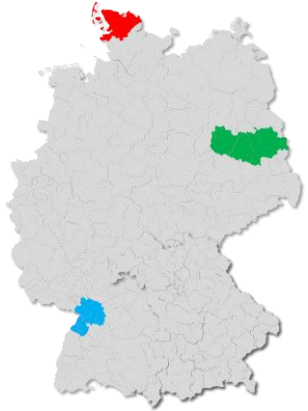
Set up of a **web tools** (Synops-Web+) for counselling of farmers



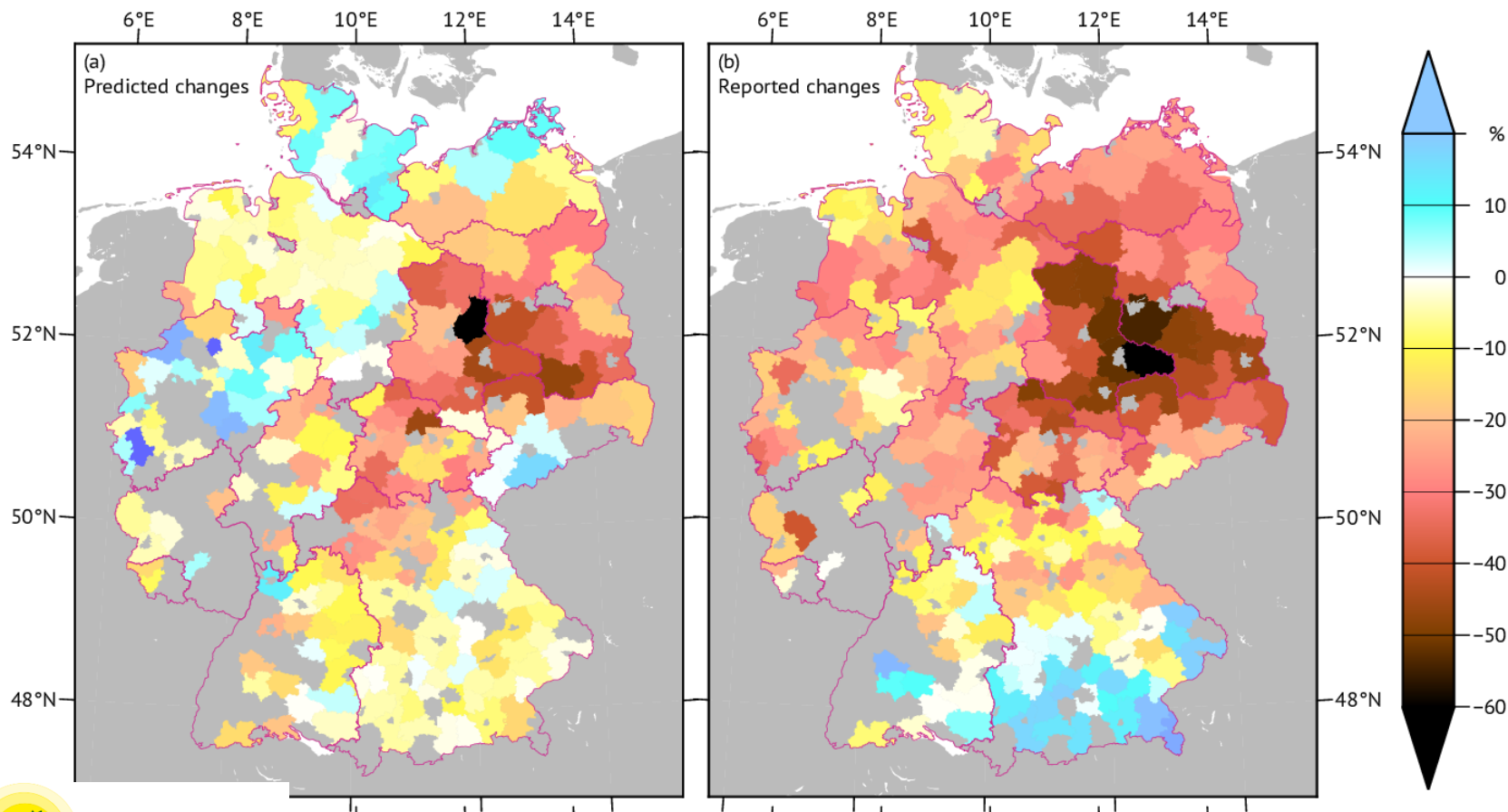


- **Optimization of cropping strategies and derivation of regional recommendations**
→ Multi goal optimization

- Provision of the results in an **OptAKlim web portal**
- Provision of **extension tools Synops-Web+ (Decision support)** for a site specific estimation of environmental risks by crop protection applications
 - + economic evaluation of climate adaptation strategies
 - + comparison of GHG emissions for various cropping options



Example of a weather-based single-year forecast for silage maize yields (silage maize 2019, relative deviations from the mean county yields of the years 2012-2017)

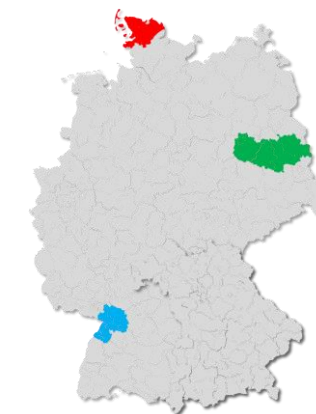
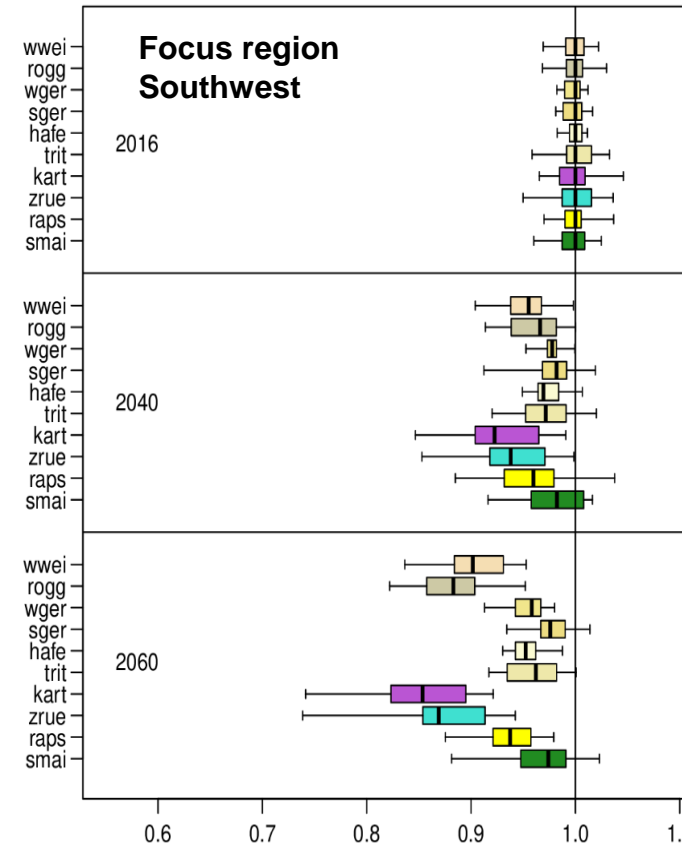
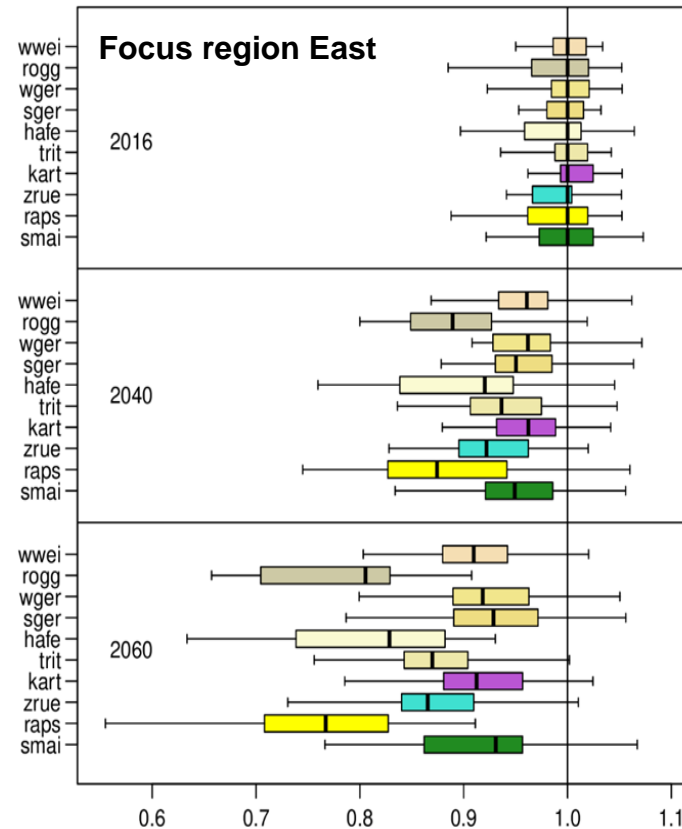
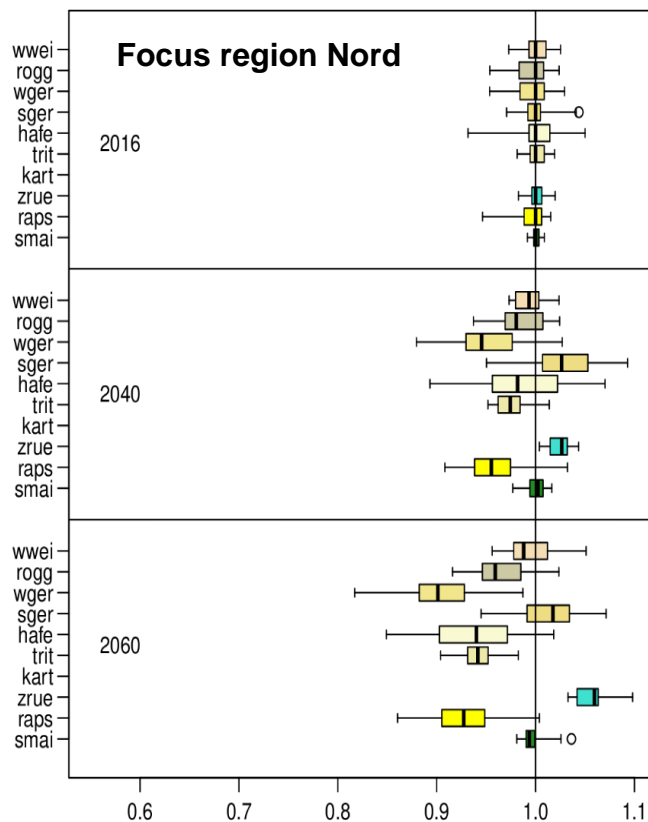


ABSOLUT: Statistical model using last 30 years yields and climate data for model building (Conradt et al. in press)

Impacts on silage maize yields

- Temperatur April–August or June–August, **-40 dt/ha per 1°C increase**
- Precipitation April–August, **+/- 3 dt/ha per 1 mm change**
- Temperatur March–May, **+20 dt/ha per 1°C**



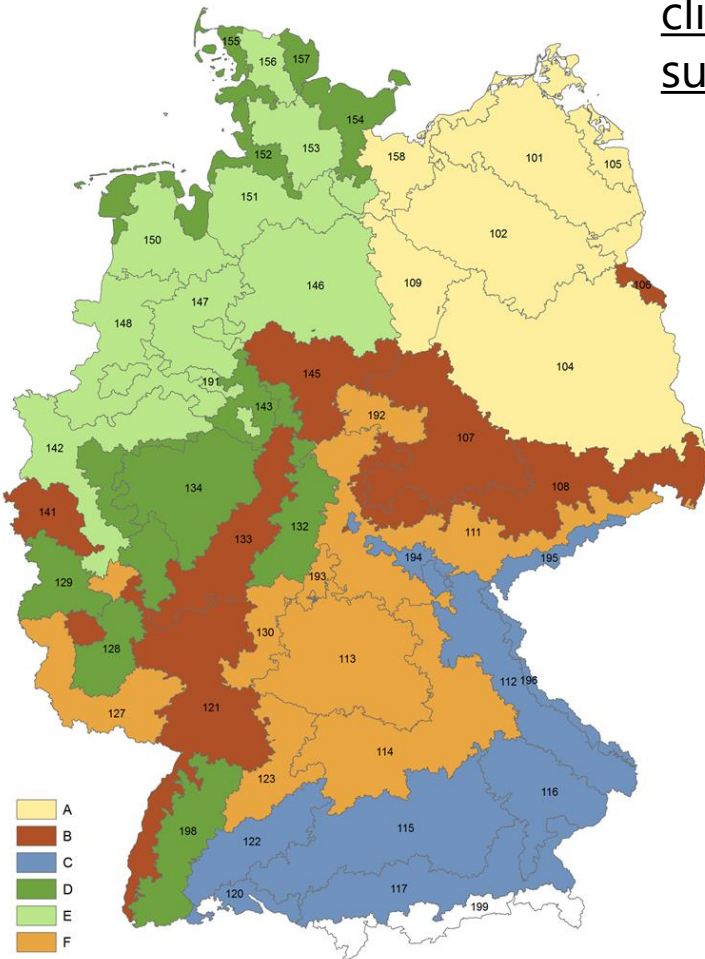


Legend:

wwei = WinterWheat;
rogg = WinterRye;
wger = WinterBarley;
sger = SpringBarley;
hafe = Oats;
trit = Triticale;
kart = Potatoes;
zrue = Sugar beets;
raps = WinterRape, Canola;
smai = Silage maize.



CEPI - 6 Cluster



Prediction of regional plant protection patterns under climate change based on survey data

Data basis: Network of comparative crop protection farms (VGB) and PAPA farm network (2010-2018).

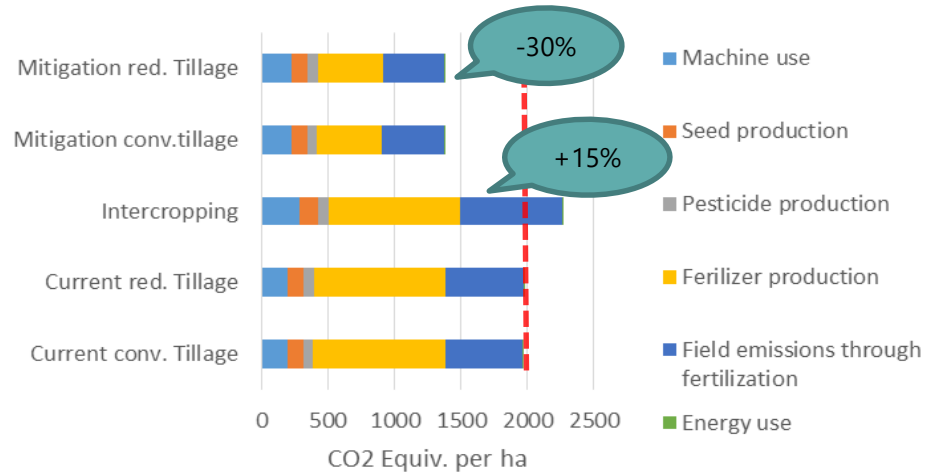
Crops: winter wheat, winter barley, winter rape, winter rye, triticale, maize, sugar beet, potatoes

Farm data in the major regions CEPI (Cluster for the regional survey and analysis of crop protection intensity)

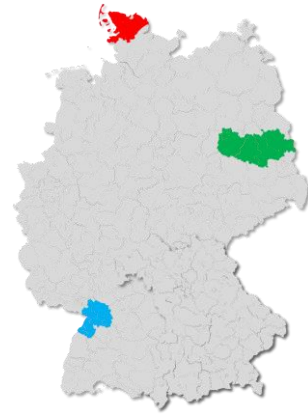
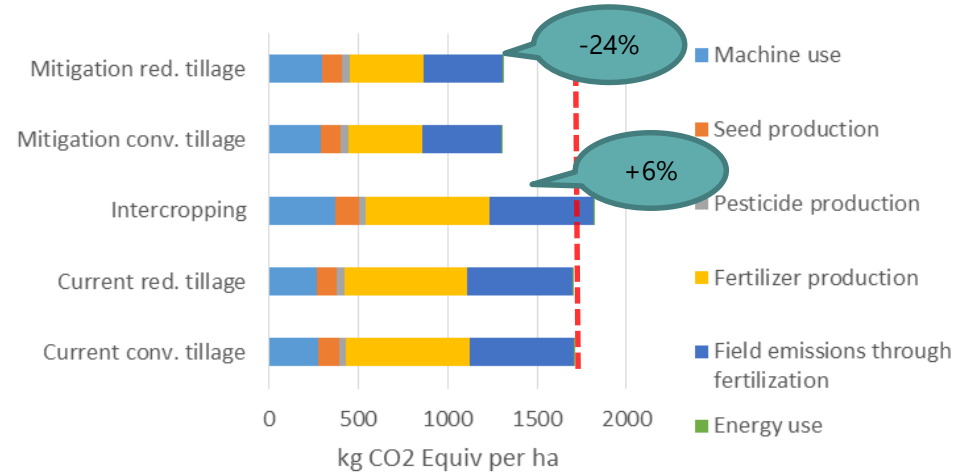
Crop	Weeds	Pests	Fungal diseases	Growth regulator
WinterWheat	→ Changing species composition	Cereal aphids, wheat gall midge, cereal chickens ↑	Brown, yellow and black rust, eyespot, ear fusarium ↑	↓
WinterBarley		↑	Dwarf rust, barley blight ↑	↑
WinterRye		→	Varying trends Brown rust → Fusarium ↑ Stalk blight and Rhynchosporium leaf spot disease ↓	↓
WinterRape/Canola		Small cabbage fly, rape seed flea, stem weevil, rape seed beetle, cabbage pod weevil, cabbage pod midge ↑	Whiteness ↓ Alternaria ssp, Phoma lingam ↑	↑

Crop	Status quo			Future		
	PSM-Kategorie	Treatment index (BI)	Trips (Number of products)	Treatment index (BI)	Trips (Number of products)	Trend
Maize	Herbicides	1,9	1 (3)	2,4	2 (5)	
	All	1,9	1 (3)	2,4	2 (5)	
WinterRape/Oilseed	Herbicides	2,2	3 (5)	3,5	3 (6)	
	Insecticides	3,0	3 (3)	5,0	5 (5)	
	Fungicides	2,1	3 (3)	2,6	4 (4)	
	All	7,2	7 (11)	11,7	8 (13)	
WinterRye	Herbicides	1,6	2 (3)	1,6	1 (1)	
	Fungicides	1,7	2 (3)	2,0	2 (3)	
	Growth reg.	0,4	1 (2)	1,1	1 (2)	
	All	3,7	4 (8)	4,7	4 (8)	

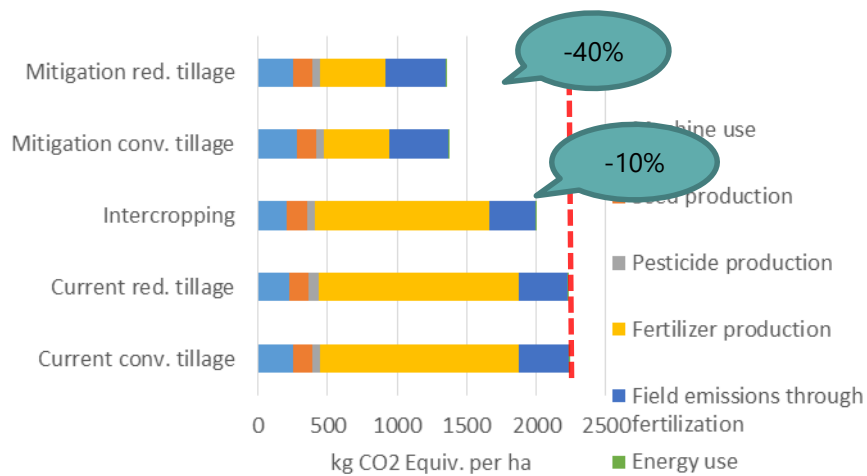
WWheat after WRape Nord(Hue)



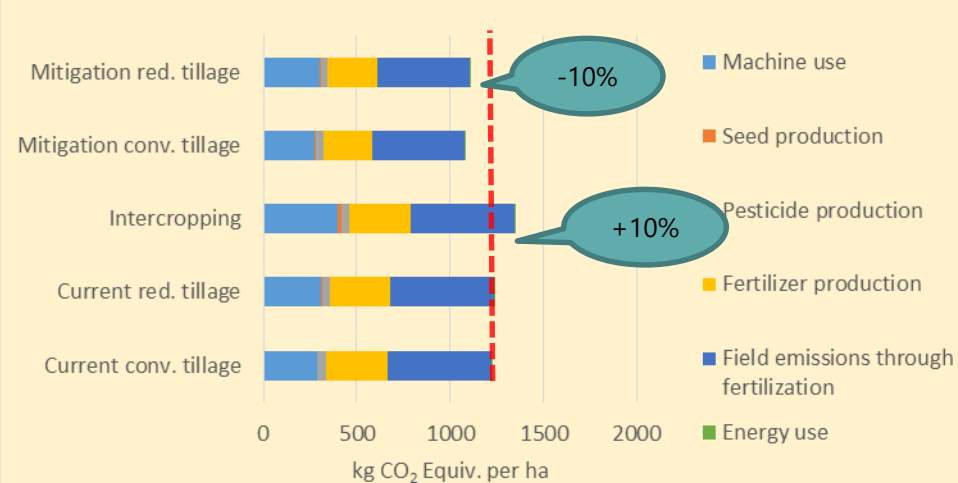
WWheat after WRape East



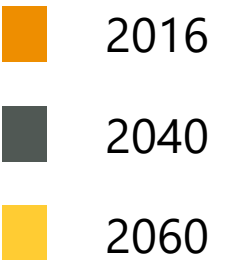
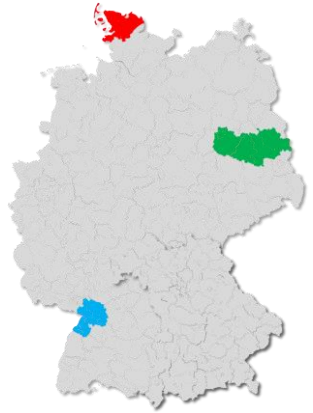
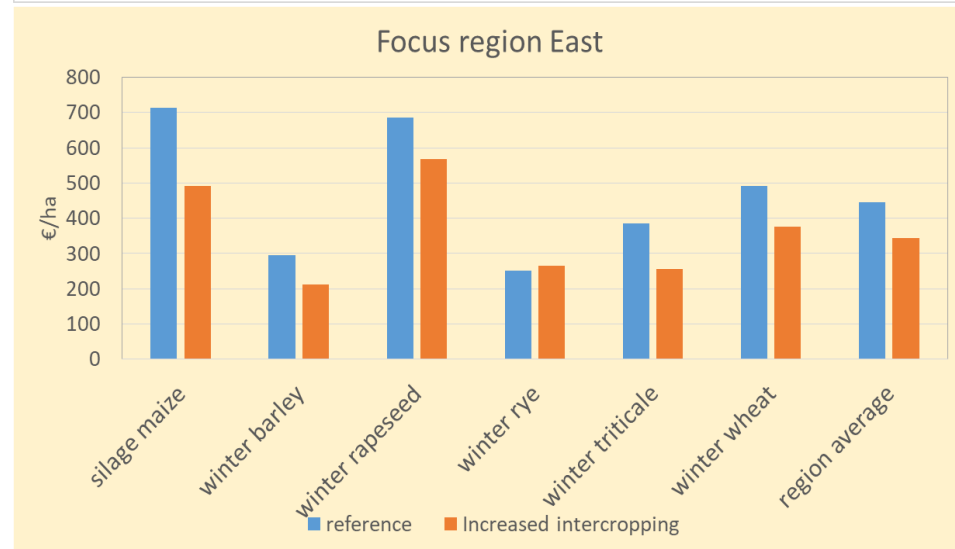
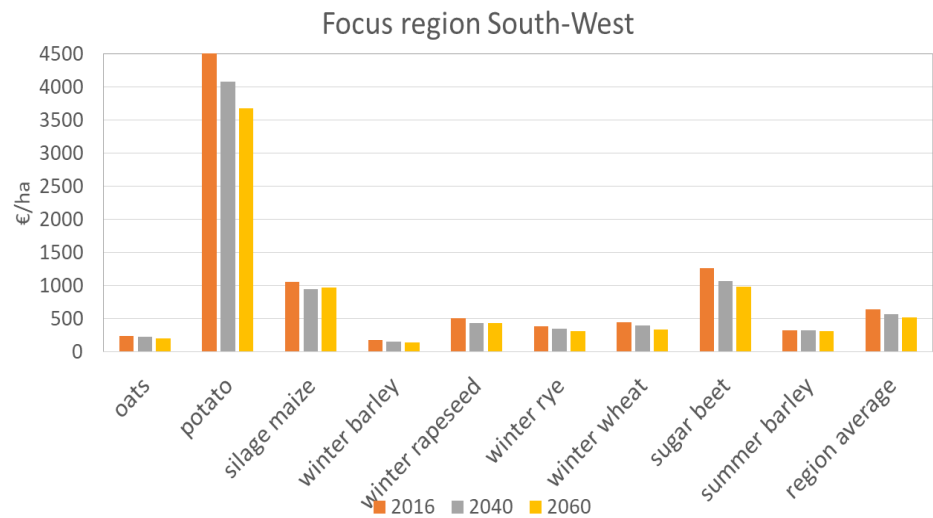
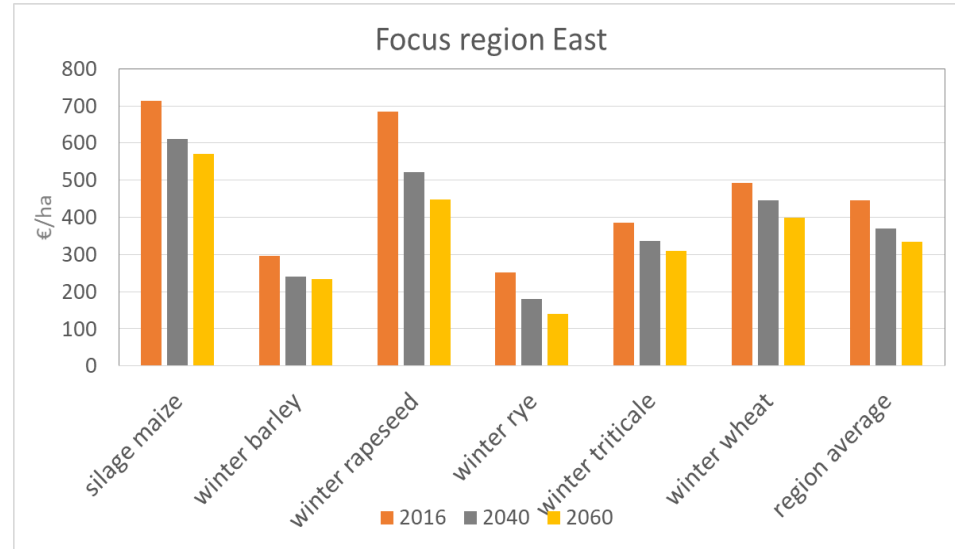
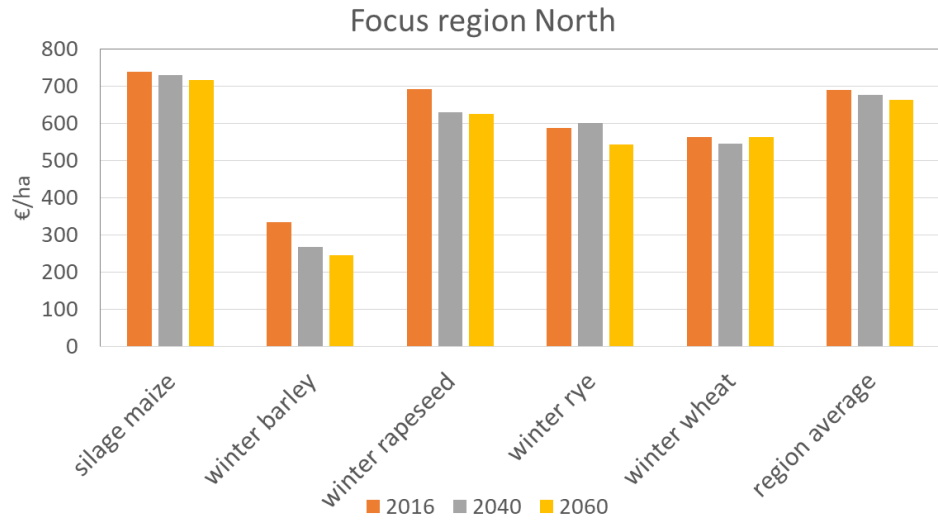
WWheat after WRape SW



WRape after WBarley East



Change in Gross Margins by Climate Change Scenarios



Consideration of regional capabilities and potentials is essential part of sustainable development

- Manifestation of climate change vary regionally (warm winters <– > dry summers)
- Impacts on yields vary regionally (yield risk)
- Future plant protection demand vary regionally and depend on the cropping structure
- Efficiency of GHG mitigation measures vary regionally and depend on the cropping structure
- Economic consequences of climate change effects and mitigation/adaptation pathways vary regionally and depend on the cropping structure

High complexity of interactions



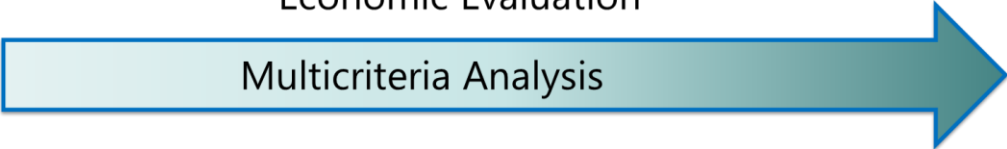
Local actions (farmers) need support!!

Step 1
Single crop field

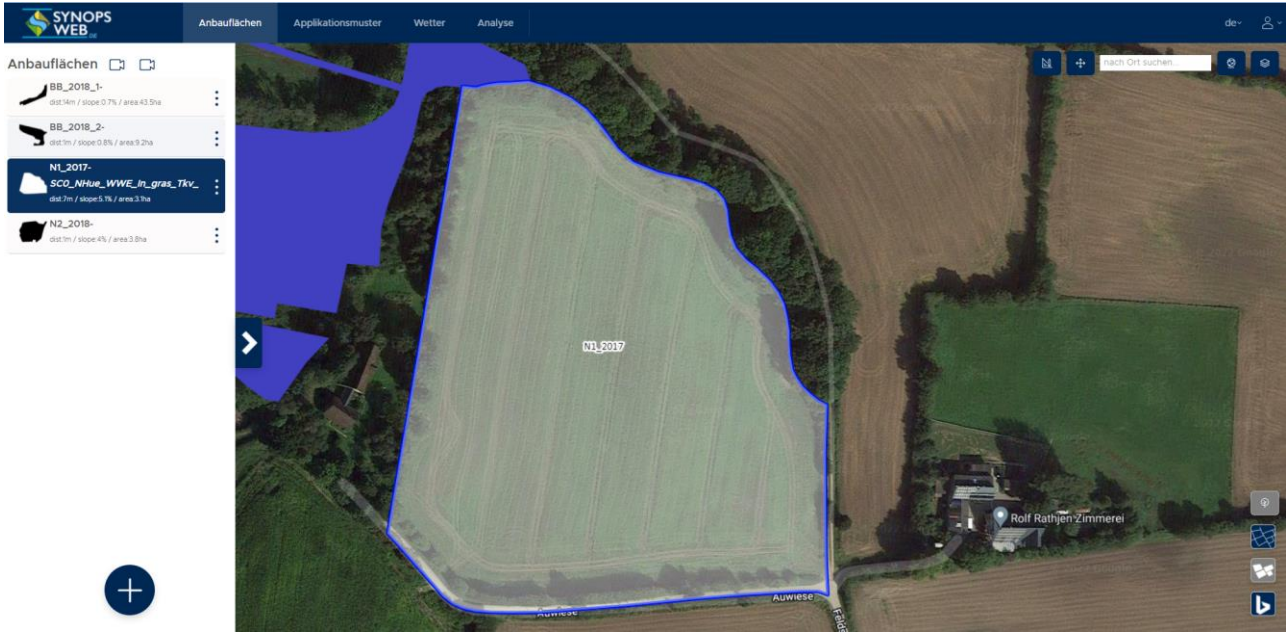
Step 2
Scenario selection

Step 3
Risk assessment

Plant protection environmental risk
GHG-Emissions (Mila)
Economic Evaluation

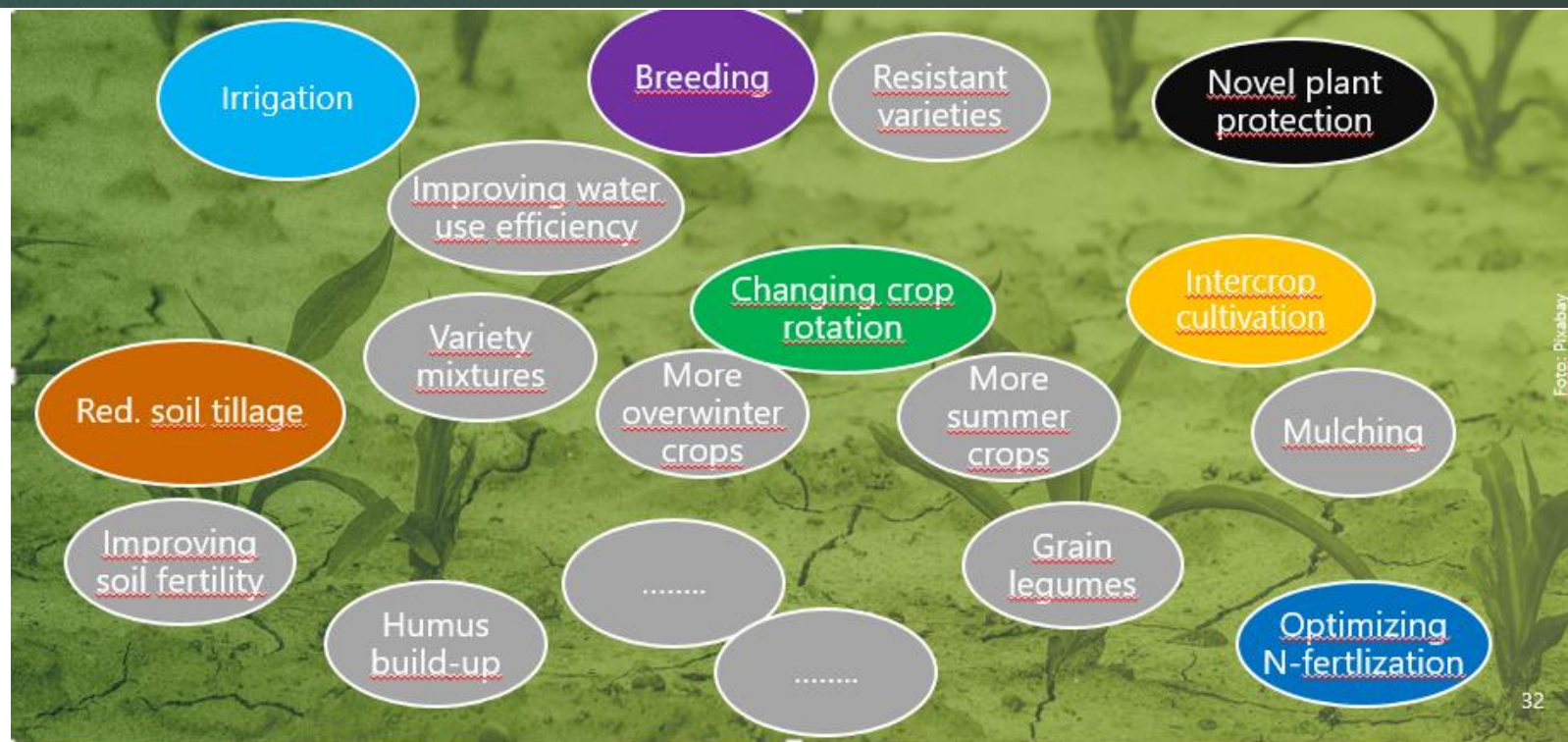


<http://synops.julius-kuehn.de>





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