

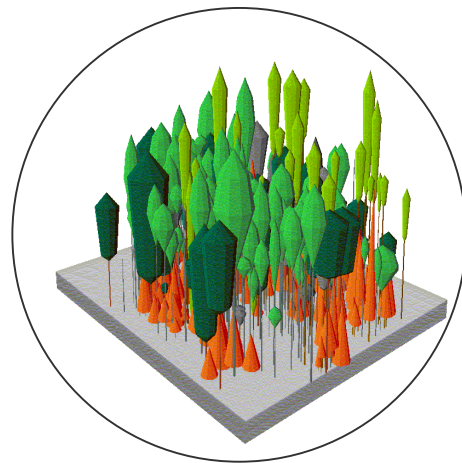
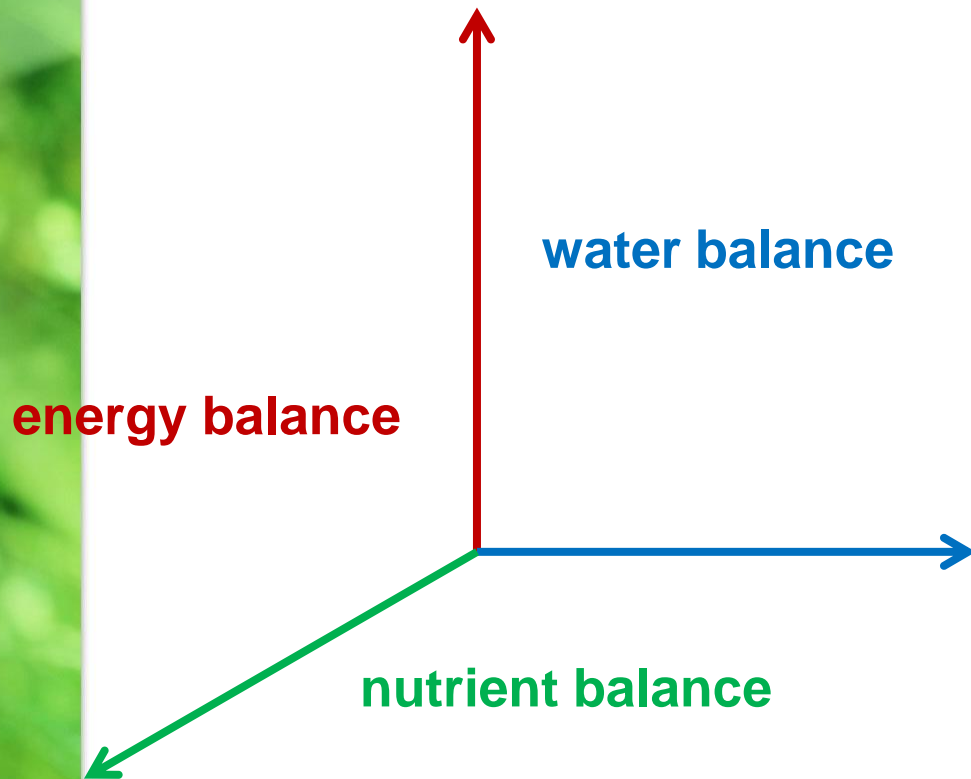
# Impacts of climate change on mountain forest sites

Michael Englisch

Department of Forest Ecology and Soil

**FAO/ EUSALP Conference on the “Protective Functions of Forests in a Changing Climate”**

# Primary Site Factors – up to now $\pm$ stable within at least one rotation period ( $>100$ years)



→ **forest site,**  
**potential**  
**natural vegetation**

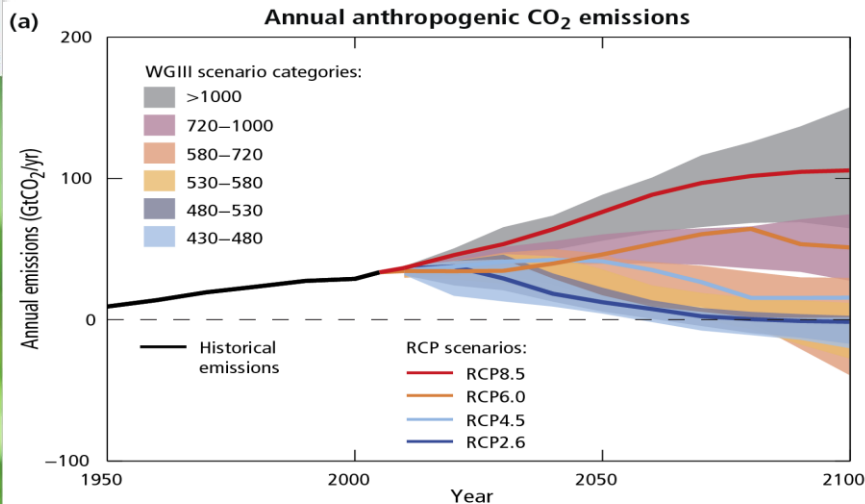
# Climate change: Reference data sets and scenarios

**ENDBERICHT ÖKS15 | KLIMASZENARIEN FÜR ÖSTERREICH  
DATEN - METHODEN - KLIMAANALYSE**

**FINAL REPORT ÖKS15 Climate Szenarios for Austria – Data, Methods,  
Climate Analysis**

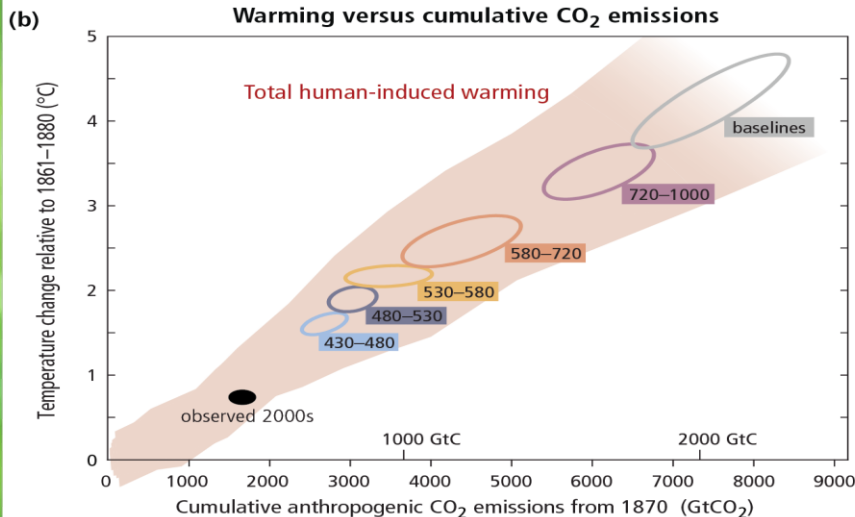
**(BMNT,**

**[https://www.bmnt.gv.at/umwelt/klimaschutz/klimapolitik\\_national/anpassungsstrategie/klimaszenarien.html](https://www.bmnt.gv.at/umwelt/klimaschutz/klimapolitik_national/anpassungsstrategie/klimaszenarien.html)**)



(Representative Concentration Pathways - RCPs)

*Named according to change of radiative forcing until 2100 in respect to pre-industrial era.*



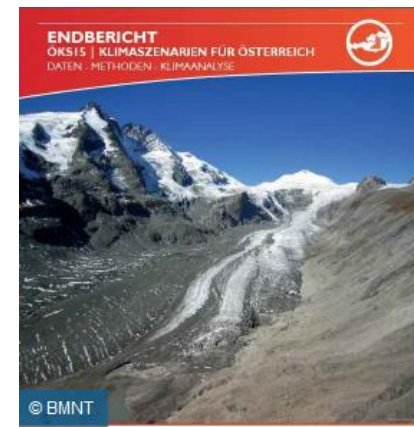
sources:

IPCC AR5;

<https://www.ipcc.ch/report/ar5/syr/summary-for-policymakers/>

<https://wiki.bildungsserver.de/klimawandel/index.php/RCP-Szenarien/>

# ÖKS 15



Based on EURO-CORDEX data sets

Calculated for RCP 4.5 and 8.5, based on a combination of 6 regional with 5 global climate models, resulting in 13 different climate projections.

Since all models currently have to be considered as equally valid:

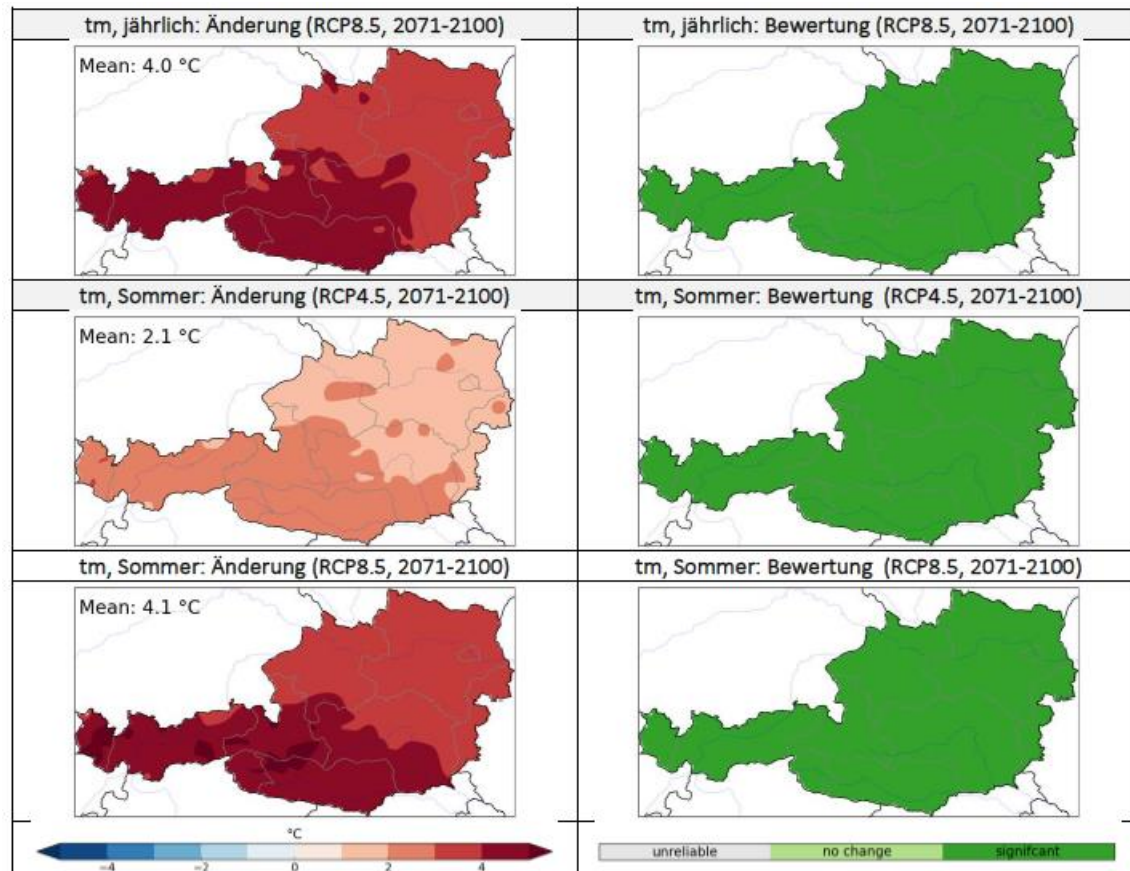
**Median** for each ensemble used in final report („Correct, but possibly wrong“)

Time horizon: 2021-2050 (**near future**), 2071-2100 (**far future**)

Significance, spatial error

# Mean Annual Air Temperature

	2021/50	2071/2100
RCP 4.5	+1,3	+2,3 °C
RCP 8.5	+1,4	+4,0 °C



Source: BMNT

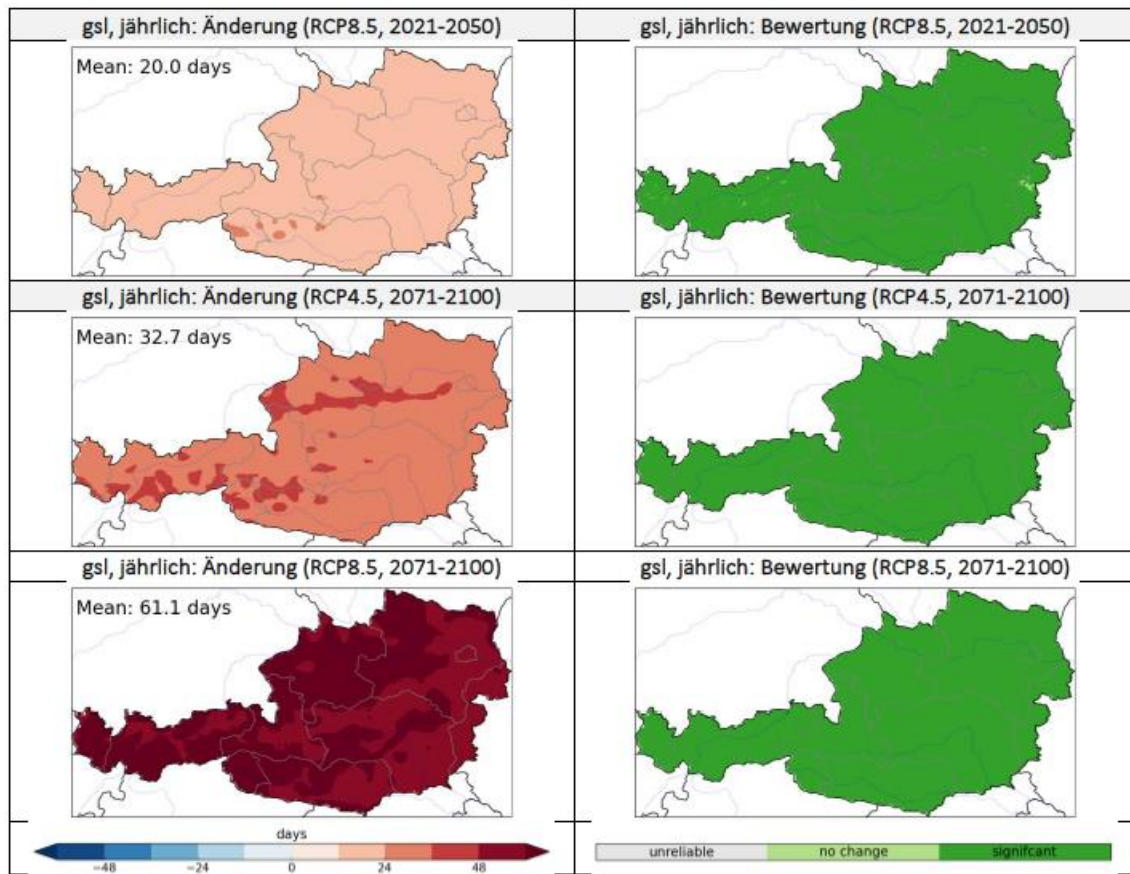


# Vegetation period

	2021/50	2071/2100
RCP 4.5	n.s.	+ 32.7 d
RCP 8.5	+ 20	+ 61.1 d

→ main chain  
of the Alps

Source: BMNT

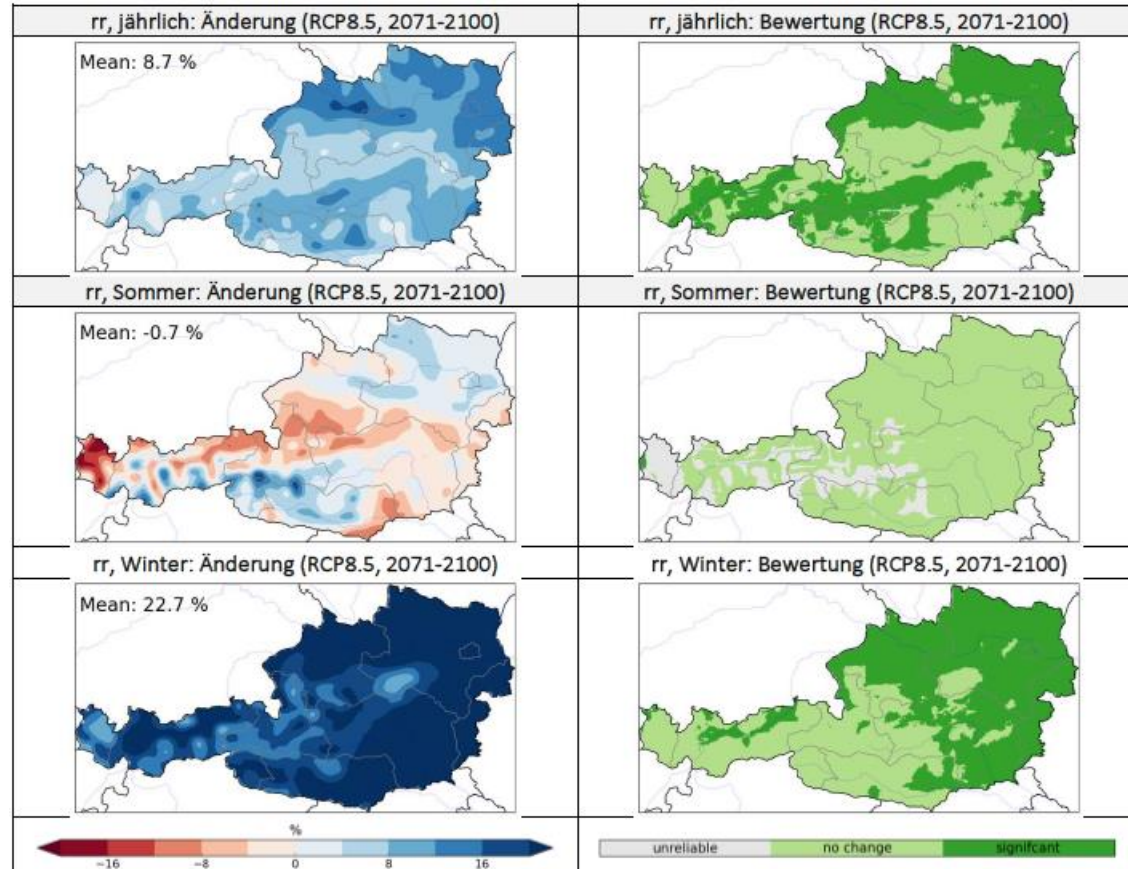


# Annual precipitation

	2021/50	2071/2100
RCP 4.5	n.s.	7.1 %
RCP 8.5	n.s.	8.7 %

→ main chain  
of the Alps

Source: BMNT





# Possible influences of climate change on forest sites

- **Possibly increased weathering** → possibly increased nutrient supply (increase dependant on substrate group)  
$$BC_w = z \cdot 500 \cdot (WR_c - 0.5) \cdot \exp(A/281 - A/273 + T)$$
 [Sverdrup 1990]
- **Faster decomposition of organic substance**, increase of CO<sub>2</sub> emissions from soil (short-term: increased nutrient supply, mid-term: nutrient losses caused by leaching), **Carbon losses** especially from (Rendzic) Leptosols (1 t.ha<sup>-1</sup>.y<sup>-1</sup> [Prietzl 2016, up to 2-3 t.ha<sup>-1</sup>.y<sup>-1</sup> Schindlbacher et al. 2017])
- Higher air temperature, ± similar precipitation:  
→ increase of (evapo)transpiration; → increase of water consumption of vegetation (trees) → ? Changes in soil and site hydrology

# Biomass production in 2040: + 1,5°C; precipitation +20%; 0%; seasonal shift; -20 % (forest and agriculture)

Warming possibly results in increases of biomass production in the Western parts of Austria and decreases in the Eastern parts  
 Results of modelling

Source: Kirchner et al. (2015)

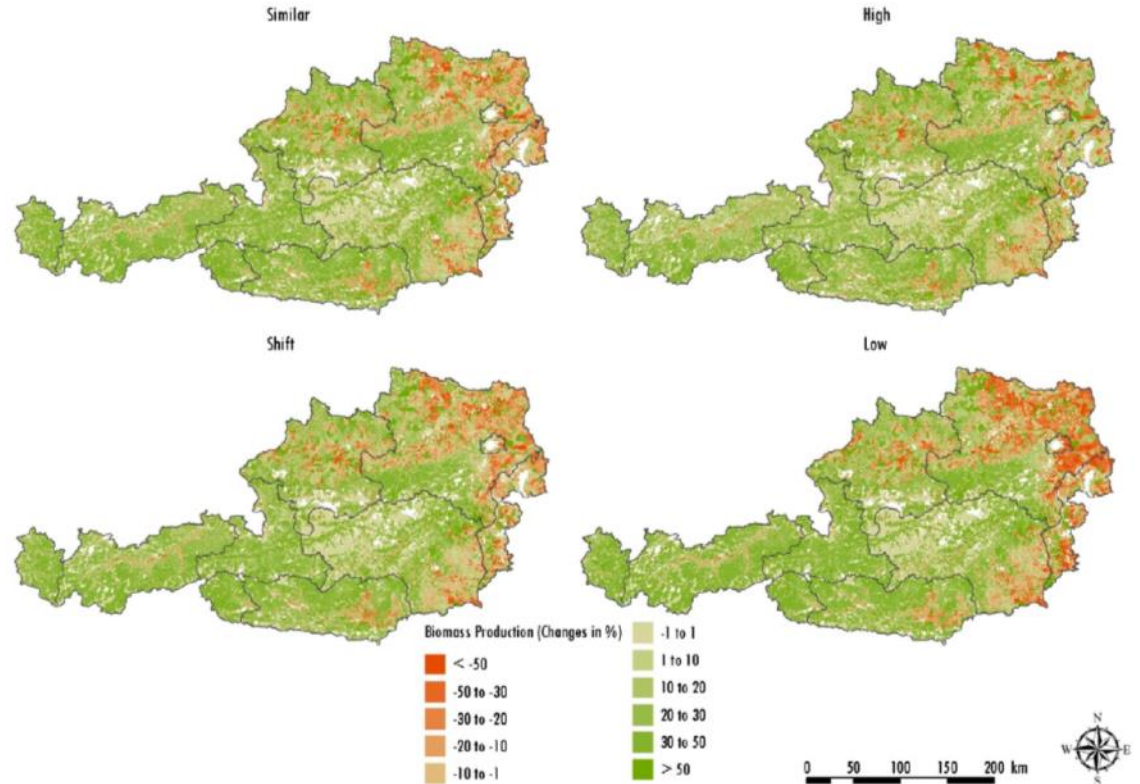
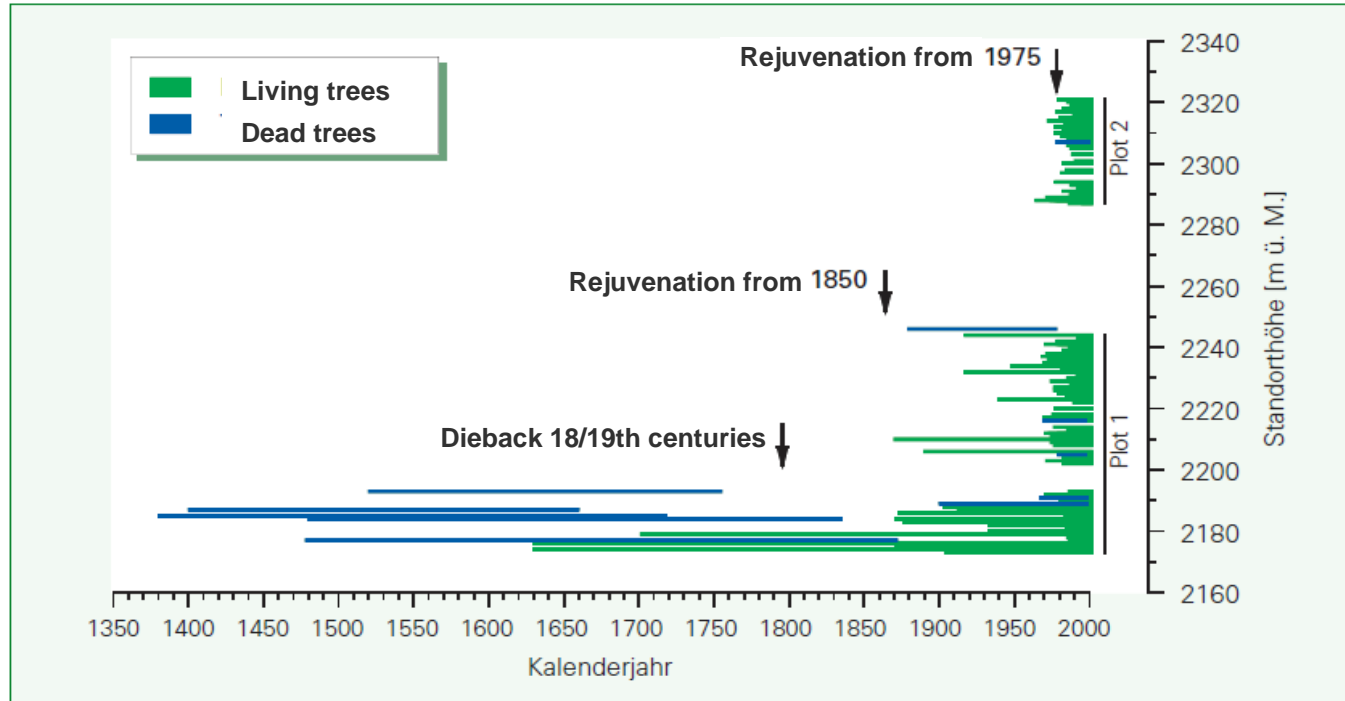


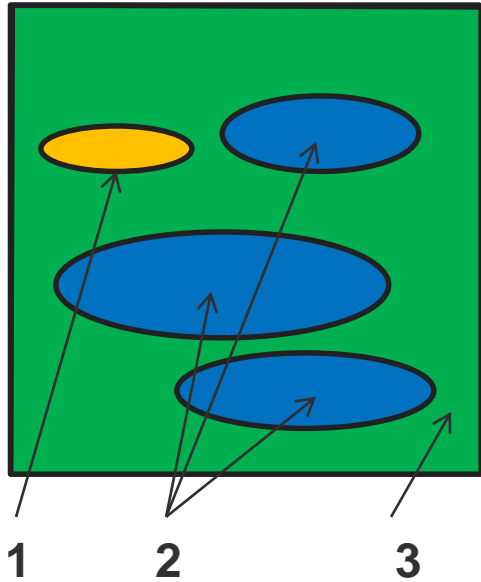
Fig. 4. Percent changes in total biomass production on agricultural land including afforestation in BAU for all climate change scenarios at 1 km grid resolution (compared to REF).

# Changes of Alpine timber line; *Pinus cembra* (Nicolussi & Patzelt 2006)

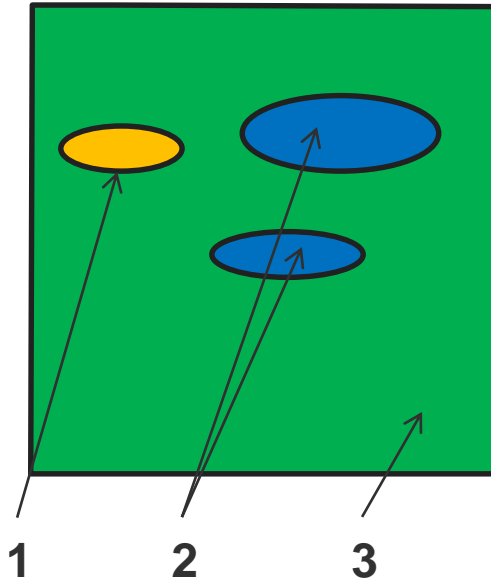


# Changes of forest types (current, near future, far future) generalized example

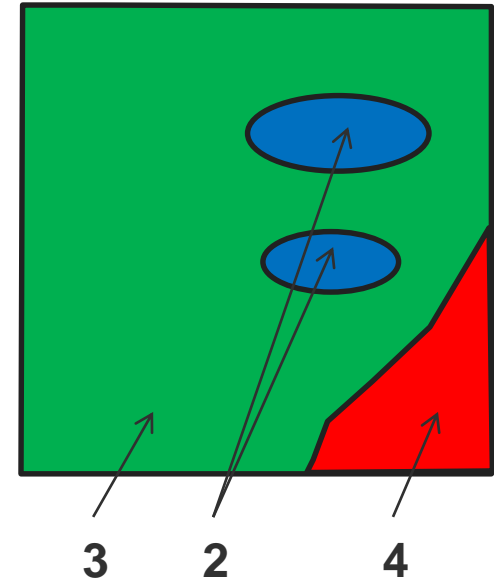
2020



2050



2080



# Project FORSITE: Forest typification of Styria

Spatially explicit (scale ~ 1:25.000) modelling of forest types of Styria (present, near future, far future)

Based on 1800 plots (geology, soil, vegetation, forest growth);

ÖKS 15 RCP 4.5 & 8.5; relevant information layers of GIS Styria; Results: 2021

Consortium:

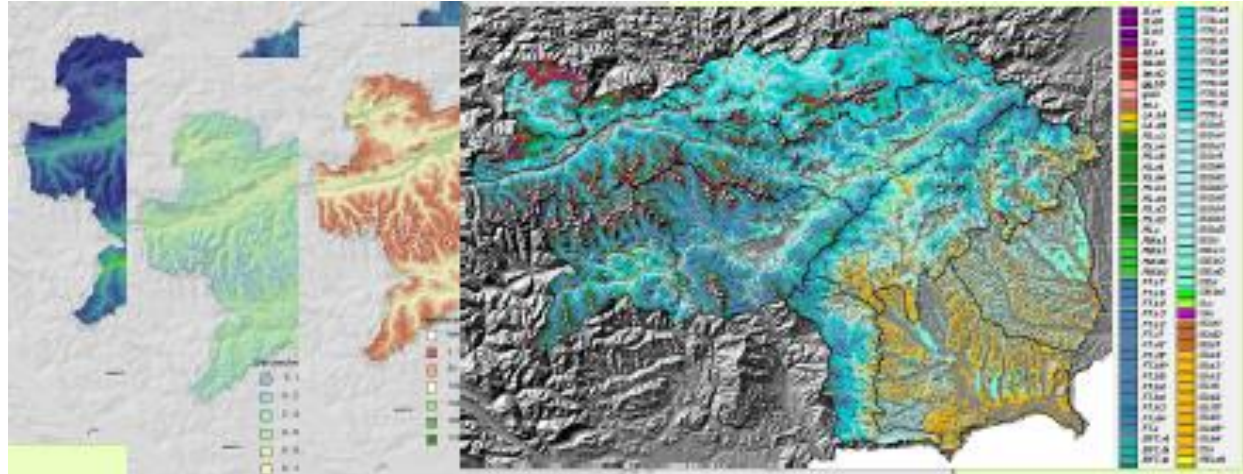
BOKU

BFW

Univ. Graz

Joanneum

WLM AlpeCon



Mit Unterstützung von Bund, Land und Europäischer Union



# Thank you for your attention !

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