Impact of climate change on grassland productivity and forage quality in Austria

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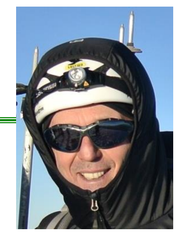

About the background

Climate change scenarios assume an increase of temperatures and atmospheric CO_2-concentration for the next few decades and forecast less rainfall in the vegetation period for the alpine space. All these changes will affect grassland productivity concerning yield and forage quality

What we did

Field experiments were established on 27 different Austrian grassland sites

The experimental design included three cutting frequency levels (2, 3 and 4 cuts year^{-1}) each with an appropriate intensity of fertilization (0.9, 1.4 and 2.0 LU ha^{-1})

The average yearly temperature of the sites varied from 6.4 – 11.1 °C with an annual precipitation of 548 – 1,440 mm

The sites (209 – 1,100 m a.s.l.) were clustered into four typical climate groups

What we found out

▼ Dry matter yield was significantly influenced by year, climate group and management intensity, explaining > 90% of the observed variation

Table 1. Yield data of Austrian grassland under varying climate conditions

	Climate groups			
	humid/warm	humid/cold	arid/warm	arid/cold
2002 - 2011				
DM-yield (t ha^{-1} year^{-1})	8.10^{a}	8.32^{a}	6.82^{b}	7.55^{c}
2003				
DM-yield (t ha^{-1} year^{-1})	8.14^{a}	8.96^{a}	4.83^{b}	5.73^{b}

a, b, c – indicate significant differences between climate groups (p<0.05)

◄ Highest yields were overall achieved under humid conditions. Significantly lower yields were recorded under arid conditions with a strong decline of 29 % in arid/warm regions and of 24% in arid/cold regions in the dry year 2003

In contrast to the dry matter yield the CP-content and the energy concentration were not negatively affected by the dry conditions in 2003 ►

Due to the strong yield decline, considerable differences occurred for energy yield and crude protein yield under arid conditions ►

Table 2. Forage quality of Austrian grassland under varying climate conditions

	Climate groups			
	humid/warm	humid/cold	arid/warm	arid/cold
2002 - 2011				
CP (g kg DM^{-1})	115.2^{a}	117.7^{b}	118.6^{bc}	120.8^{c}
MJ NEL (kg DM^{-1})	4.53^{a}	4.79^{c}	4.65^{b}	4.90^{c}
2003				
CP (g kg DM^{-1})	135.2^{a}	134.0^{a}	145.7^{b}	131.9^{a}
MJ NEL (kg DM^{-1})	4.49^{a}	4.87^{b}	4.84^{b}	4.92^{b}

a, b, c – indicate significant differences between climate groups (p<0.05)

What we conclude

- **There is a strong spatial variability in the impact of climate change on grassland yield**
- **Forage quality is mainly affected by management intensity and to a less extent influenced by extraordinary weather conditions**
- **Climate change requires different and spatially adjusted strategies of adaptation**