

## IMPACT OF CHANGING CLIMATE ON GRASSLAND PRODUCTIVITY – CASE STUDY IN TWO CONTRASTING GEOGRAPHICAL LOCATIONS

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### ABSTRACT

One of the most important factors influencing grassland productivity in Europe is climate, and climate fluctuations are intensifying in recent decades. The changing climate affects grassland growth, its water conditions, biomass, and subsequently yield in Poland as well as in northern Norway. In Poland, increase of air temperature, water shortage and unfavourable precipitation distribution during the growing season are factors limiting grassland productivity. In northern Norway, in regard to climate warming, the prolonged growing season and extreme winter events influence the growth and development of grasses. The effects are confirmed by truth ground data collection on site and grassland monitoring by remote sensing. This justifies the need for investigating the impact of climate variables on grassland yield, which will support the elaboration of a reasonable model of grassland development, its management and utilization in the changing environment.

This objectives of this study are 1) to evaluate the trends of climate variables in two contrasting geographical locations in Europe (northern Norway and central Poland), and 2) to assess the influence of the detected trends on yields of productive grassland as well as timothy (*Phleum pratense*) as reference grass, a species which plays an important role in forage grassland production in both regions.

In our approach, the impact of changing climate on grassland productivity were investigated at regional and site levels. The meteorological data were collected beginning in 1985 during a 30-year period for Troms (Norway) and Wielkopolska (Poland) regions based on statistical data sources, and for Holt (Norway) and Brody (Poland) as experimental sites of the Norwegian Institute of Bioeconomy Research and Poznan University of Life Sciences, respectively. In searching for significant trends of climatic variables that may also have significant impact on grassland productivity, the Mann-Kendall test was used. Focusing on the second objective of the study, simple linear regressions were run using dry matter yield (DMY) of grasslands for each region (statistical data) and DMY of productive grasslands and timothy for each site (experimental data) as the dependent variable, and meteorological various variables as independent variables. Additionally, the surface temperature (Ts) and Normalized Differential Vegetation Index (NDVI) data from 250m MODIS satellite data for each region and site were used to analyze the relationships between meteorological variables and DMY of grasslands. The statistical calculations were made in the R software environment.

The results show significant positive trends over time in the average annual air temperature, and average temperatures for six individual months (4, 6-9, 11) in Wielkopolska and Brody, while in Troms and Holt, only May temperatures were found to be increasing with statistical significance. Additionally for Troms, the decrease of average air temperature in January was confirmed. Precipitation has decreased in December in Wielkopolska and Brody, whereas spring precipitation (March and April) has increased at Holt. Growing degree-days have increased in Brody and Holt. Growth start in spring is earlier in Wielkopolska. The trends over recent decades of climatic variables have had different impact on DMY of productive grassland as well as timothy in both contrasting geographical locations in northern Norway and central Poland.

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Session: Vegetation condition (critical levels and loads – air pollution, climatic thresholds, tolerance and/or resilience)