Geophysical Research Abstracts, Vol. 7, 08383, 2005
SRef-ID: 1607-7962/gra/EGU05-A-08383

Method for Estimation of the Permanent Grassland Yields During „Normal“ and „Dry“ seasons

M. Trnka(1), J. Eitzinger (2), G. Gruszczynski (2), H. Formayer (2), M. Dubrovsky (3)

(1) Institute for Landscape Ecology, Mendel University of Agriculture and Forestry Brno (MUAF), Czech Republic (mirek_trnka@yahoo.com), (2) Institute of Meteorology, University of Natural Resources and Applied Life Sciences (BOKU), Vienna, Austria (josef.eitzinger@boku.ac.at), (3) Institute of Atmospheric Physics, Czech Academy of Sciences, (IAF), Prague, Czech Republic

Grasslands used either for forage production or as pastures compose significant portion of Austrian territory (22% or 1.9 mil. ha), constitute an important landscape feature as well as part of the agriculture production system. In the same time grassland production vary considerably among years and also among cuts due to the climatic factors. This is of major importance to dairy farmers since the whole farming system must account for the risk of unfavorable weather conditions. The main aim of the presented work therefore was to set up a reliable statistical model for grasslands under various management regimes and apply it over a range of tasks. The GRAssland statistical Model (GRAM) was calibrated and evaluated using the long-term field experimental data from three Austrian sites at Gumpenstein (1961-2001), Piber (1971-2001) and Admont (1977-1999). GRAM performance was then thoroughly tested with focus on its predicting capability during so-called “extreme years” that were characterized by either extremely dry or extremely wet course of the weather assessed by Standard Precipitation Index (SPI). Finally GRAM was coupled with Met&Roll stochastic weather generator into an interactive system in order to provide grassland yield estimates early in the season.

Two versions of the GRAM model were created; first designed for use under various management regimes while the second is attempted for use under the most common management practice i.e. 3 cuts per season. We have found that in both case GRAM is capable to explain up to 75% of the variability with insignificant systematic bias and

negligible random error. The analysis of the model performance during years characterized by the “dry” weather (i.e. accumulated SPI $<$ -1.0) showed approximately same value of explained variability (73%) as over the whole dataset (75%). Also the systematic and random errors were very similar to the whole dataset with deviations smaller than 1.5%. No statistically significant difference was found in case of GRAM performance during „dry“ years compared to the whole dataset. In 7 (out of 88) cases grassland production was overestimated by more than 25% whilst in 13 cases the model underestimated yield at least by the same magnitude. When this model was applied over the “wet” data set similar results were found. In general GRAM model was found to perform slightly better under wet years than under dry ones.

As the GRAM fits easily into the GIS environment it might prove as a useful approach for objective spatial evaluation of drought impacts and identification of hardest hit areas e.g. in case of insurance companies. It could also help to identify areas potentially vulnerable to drought . Moreover GRAM in combination with stochastic weather generator proved to be an effective way for yield estimates early in the season thus allowing decision makers or farmer taking necessary steps prior to potential low/high harvest. The main advantage of the model is the possibility to calibrate it with very limited data set compared to complex grassland models and to deliver relatively satisfactory yield estimates under range of environmental conditions.

Acknowledgement : This study was conducted in cooperation with the Federal Research Institute for Agriculture in Alpine Regions, Gumpenstein, Austria.