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## **Biomass production of Grasslands: Spatial distribution of biomass production and feed demand in two contrasting regions of Bavaria, Germany**

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For agriculture, biomass production for feeding livestock is an essential ecosystem service of grasslands. In line with the European Green Deal's farm-to-fork strategy, maximizing fodder production from existing grasslands is more sustainable than relying on high-intensive cropland feed. Reducing imports and dependency on cropland feed is a global environmental goal. However, it remains unclear whether current grassland resources can sufficiently meet livestock's energy needs. This study assesses the balance of metabolizable energy (ME) from grasslands in two contrasting regions of Bavaria, Germany. We estimate the ME balance per farm and year using data from the Integrated Administration Control System (IACS), including field usage, livestock information, and modeled yield data. We analyze variations between a dry year (2018) and a typical year (2020) under conventional and organic farming. Results show an average ME deficit of ~1,000 GJ per farm (equivalent to 17 dairy cows) in northern Bavaria, whereas the (pre-)Alpine region in southern Bavaria generally shows surpluses, roughly one potential additional dairy cow per farm (~60 GJ surplus). Within the southern region, a north-south trend appears, with deficits in the north and surpluses in the south. No clear pattern emerges in northern Bavaria. Organic farms tend to exhibit higher ME surpluses than conventional farms. A geographically weighted regression reveals that elevation, precipitation, agri-environmental schemes, and farming practices significantly influence ME balances, with effects varying spatially. These findings underscore the need of region-specific strategies to optimize grassland fodder production and enhance the resilience of livestock farming in a changing climate.

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