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Estimating dry matter content in forage grasslands using Sentinel-2 satellite data

The dry matter and water content of leaves (usually species-specific) have been commonly studied, but few studies have investigated the capabilities of satellite remote sensing in estimating dry matter content as percentage (DMCaP) in mixed types of forage plants for agricultural applications. It is a crucial quality factor for maximizing nutrient yield and producing tasty forage for animals.

In this thesis, we evaluated the capabilities of primarily Sentinel-2 data, and combined with weather, in estimating DMCaP in forage grasslands in Southern Norway. Two types of models were developed, the interpretable model and the machine learning Random Forest Regression (RFR) model. The results showed that the RFR model performed better than the interpretable model, and the use of weather data further improved the estimation of DMCaP. The interpretable model performed better when built on individual fields respectively, suggesting that it is more suitable for data collected from nearby locations. Vegetation indices are numerical values used to quantify properties of vegetation, calculated based on different spectral bands of a remote sensing system. The use of different combinations of vegetation indices did not affect the performance of the interpretable model. The average quality and small size of the sample dataset made the estimation not very easy.

This thesis shows how satellite remote sensing can be utilized to estimate the DMCaP quality factor in small-scale forage grasslands, and thereby provide valuable insights for the forage-harvesting process and pasture management in agricultural practices.

Keywords*: dry matter content, machine learning, remote sensing, forage grasslands, vegetation index*

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