Estimation of pasture biomass to support food security in Niger

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Abstract

Livestock plays an important economic role in Niger. The mainly traditional livestock keeping (based on natural resources & low investments) is highly vulnerable due to high inter-annual variability of precipitation and hence pasture production in the Sahel. During the rainy season, the Ministry of Livestock produces monthly bulletins about the present pastoral situation, aiming to avoid overexploitation, to efficiently use available resources and to give early risk warnings. The SPOT-VEGETATION (SPOT-VGT) Normalized Difference Vegetation Index (NDVI) (1 km spatial resolution) observed at the end of the season is used to map the phytomass of pastoral areas using a linear regression parameterized with field biomass measurements. The estimated biomass, together with the estimated animal number at district level, is used to calculate a forage balance in order to identify areas potentially exposed to fire risk or forage deficits.
In the present study, we aim to improve the accuracy of the remote sensing (RS)-based biomass estimation and hence the food security management in Niger. The current approach uses a single date RS image from the end of the growing season to establish a relationship between NDVI and measured biomass. Thus the relationship is significantly driven by the spatial heterogeneity in biomass production. Our approach utilises the observed biomass variability in space and time as the relationship between measured biomass and the RS indicator is tuned using all available data from 1998–2012.
The seasonal cumulative value of the Fraction of Absorbed Photosynthetically Active Radiation (cFAPAR), calculated from 10-day image composites from SPOT-VGT, was used as RS indicator. The time interval for the computation of the cFAPAR value was dynamically adjusted for every site and every year based on the start and end of season. The results show that district level regressions perform notably better than a global regression for the entire study area, suggesting that additional and spatially heterogeneous agro-ecological parameters (e.g. grazing pressure, species composition, soil spectral properties) may have an influence on the relationship. For a better parameterization of the relationship, future research will address the identification and mapping of more homogeneous agro-ecological zones.

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