

Remote Sensing Analysis of Grass Yield Changes in Qinghai Grasslands Based on MODIS (Post-print)

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Abstract

Qinghai Province is one of the four major pastoral areas in China. Timely monitoring of grassland vegetation growth conditions and accurate estimation of grassland yield are of great significance to the sustainable development and ecological protection of pastoral areas in Qinghai. Remote sensing estimation of grassland yield is mainly based on the statistical relationship between vegetation indices and ground-measured data; however, the estimation involves factors such as vegetation indices, statistical models, and modeling indicators, and the accuracy of estimation models varies with different combinations. Based on MODIS data and ground-measured grassland yield data from Qinghai Province, this study selected six vegetation indices (NDVI, EVI, RVI, DVI, RDVI, MSAVI), five statistical models (simple linear model, quadratic polynomial model, power function model, exponential function model, logarithmic function model), and three modeling indicators (annual maximum vegetation index VI_{max} , growing season cumulative vegetation index $VI_{season-cum}$, annual cumulative vegetation index $VI_{annual-cum}$) to investigate the accuracy differences of estimation models under different combinations, and select the optimal grassland yield estimation model to estimate grassland yield in Qinghai Province in 2015 and 2016. The results show that: (1) Among the six vegetation indices, the grassland yield estimation based on NDVI has the highest accuracy; nonlinear models have higher estimation accuracy than linear models, especially the exponential model, which is suitable for estimating the yield of most grassland types; the estimation model based on the annual maximum NDVI has the highest coefficient of determination (R^2) for most grassland types. (2) In terms of dry weight, high-yield areas ($>1,200 \text{ kg} \cdot \text{hm}^{-2}$) are mainly located in the alpine steppe in eastern Qinghai, medium-yield areas ($600\text{--}1,200 \text{ kg} \cdot \text{hm}^{-2}$) are located in the alpine steppe and gramineous grassland in southern and eastern Qinghai, and low-yield areas ($<600 \text{ kg} \cdot \text{hm}^{-2}$) are located in the alpine meadow, alpine steppe,

alpine desert, and saline meadow in western and northern Qinghai. (3) Compared with 2015, the total dry grass yield in Qinghai Province in 2016 decreased by 31.60×10^4 t, a reduction of 1.36%. Among them, gramineous grassland and alpine meadow showed the largest yield reduction, while the yields of desert steppe and saline meadow increased. This study can provide a reference for research and practice in remote sensing estimation of grassland yield.

Full Text

Preamble

Note: Figure translations are in progress. See original paper for figures.

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