Monitoring Natural Pasture Status in Uruguay Using Satellite Images and a Soil Water Balance Model

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Introduction Cattle beef production in natural grasslands is the dominant agricultural production system in Uruguay . Monitoring and information about the current status of natural pastures is very important for planning and decision making at farm and government level , to prevent cattle beef production losses . INIA , jointly with other national and international institutions , has been developing an Information and Decision Support System (IDSS) for monitoring the status of natural pastures in Uruguay . The IDSS is based on tools like remote sensing , Geographic Information Systems and models .

Objectives The main objective of the IDSS is to offer almost real time information about the natural pasture status and the soil water content in natural grasslands areas to support Government and cattle beef producers planning and decision making . The current IDSS is based on two main components : 1) the Normalized Difference Vegetation Index (NDVI) estimated with data coming from the Advanced Very High Resolution Radiometer (AVHRR) sensor , installed in NOAA satellites , and 2) a Soil Water Balance (SWB) model for Uruguayan soils .

Methodology AVHRR-NDVI satellite data is supplied by the Climate and Water Institute from the Argentinean Agriculture Research Institute . The NDVI is a normalized ratio of the red (R=0 .58-0 .68 mm) and near infrared (NIR=0 .725-1 .1 mm) spectral wavelengths . Monthly or 10-day maximum values of AVHRR-NDVI are estimated from daily data collected throughout the year . Monthly or 10-day NDVI imagery creates a relatively cloud-free data set by choosing NDVI pixels from days when radiance interference is lowest and sun angle is highest with the assumption that the selected pixel is most representative of actual ground reflectance (Holben , 1986) . Also , monthly NDVI anomaly imagery is created based on historic NDVI imagery data set .

The other tool used in the IDSS is the Water Balance Model for Soils of Uruguay" developed by the INIA-GRAS , Unit jointly with the Water and Soils Department of the MGAP , and the National Direction of Meteorology of Uruguay . The model estimates the soil water content by integrating the water precipitation data from 85 climate stations , the atmospheric potential water demand , the vegetation transpiration , and the water holding capacity of each soil type . This model runs daily and generates ten-day and monthly means outputs in map format of : water runoff (mm) , and soil water content (mm and%) .

Results Monthly and 10-day data and maps of NDVI and SWB are located and continuously updated in the GRAS Unit web site http ://www .inia .org .uy/gras . A monthly agro-climate report , including NDVI and SWB information , is also published in the GRAS Unit web site and sent by email to more than 10 ,000 users .

Conclusions NDVI and SWB components of the IDSS used in an integrated way , have demonstrated to be a powerful tool to monitor natural pasture status , mainly through alerting drought situations (Figure 1 and 2) . In these conditions , drought affected areas have been detected by both indices , but usually the SWB showed them earlier than the NDVI , probably due to the delayed response of plants to the water deficit .

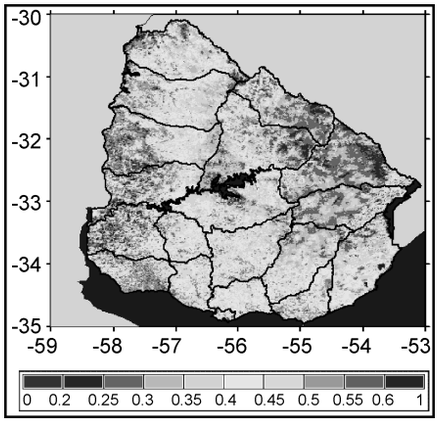

Figure 1 *NDVI (Feb-2005) .*

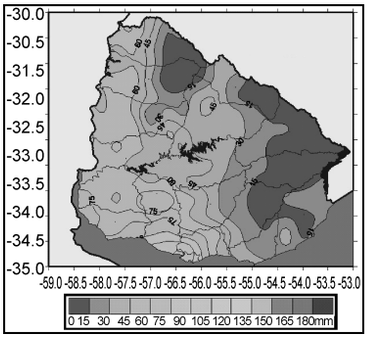

Figure 2 *Soil water content (mm) (Feb-2005) .*

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