CropView: satellite crop monitoring

Jonathan Sobels and Petina Pert
RMIT University, Melbourne, VIC

Introduction

The CropView story so far is short but throws a 'long shadow'. In 1997, it began as a PhD project at RMIT University by remote-sensing scientist Isabel Coppa. Her project was investigating the use of imagery from satellites to monitor crops in the Wimmera, Victoria. In 2001, a prototype demonstrated that it was possible to get images from a satellite to the farmer within 24 to 48 hours. In 2002, two areas of broadacre cereal farmers participated in a pilot project, one in the eastern Wimmera and the other in the eastern Riverina of southern New South Wales. Unfortunately, it was tried out in the worst drought in recorded history. A reduced series of three satellite images showed contrasting patterns in crop growth at different times of the crops' (somewhat shortened) life. Subscribers and consultants were sent a series of images by e-mail and a Viewing Kit CD in the post.

CropView paddock information

CropView is a satellite-based, crop-growth monitoring and information service that delivers timely, inexpensive information to the farmer in an easy-to-use and understandable format. The images show differences in the biomass and health of the crop across the paddock that relate to soil types and other influences on crop performance. Images can be delivered via e-mail within 2 to 3 days of the satellite overpass. From 26c per acre per image, CropView satellite imagery at 10- to 20-m resolution is a very low-cost way for farmers and land managers to get information about crop, pasture, and other vegetation, precisely located in space and time.

Managing paddock zones

Whether it is crops or pastures, satellite imagery such as CropView addresses the economic need for farmers to become more precise managers of their soil zones. They need to better understand cause and effect relationships about their paddocks' performance during the growing season. Yield maps of grain yield or kilograms of wool, milk, or meat sold at the farm gate only show the end result. Patterns in vegetative growth as measured and displayed by normalised difference vegetation index (NDVI) measures are directly related to chloroplasts and leaf structure. The crop patterns are a proxy display for all the historical, climatic, and management stories of the paddock that otherwise exist in the memories and (mostly) recent diary records of today's farmers. Farmers who are learning to interpret and apply the information in the images embark on a process that will increase their understanding of their paddocks and provide a tool for managing much greater loads of information about their crops.

Training

Perhaps most importantly, we are embarking on a training and education workshop program to introduce farmers and land managers to tools that manage spatial information. These tools include computer skills, geographic information system software, remote-sensing information products, e-mail, and the Internet. The Farm Bis program of subsidised training will ensure farmers have access to the means to manage the gathering and use of new knowledge to improve their economic and natural resource outcomes.

Managing for product quality

There is no substitute for objective, real-time information about crops and pastures and the impacts on them of your management practices. Consumers and government agencies already want greater scrutiny of farming practices, whether via quality-assurance systems, ISO 14000, or environmental management systems. Growers will be well served by the application of CropView-type imagery and information services as hard evidence and a rational basis for decisions that lower the risks and impacts of their practices, especially off-farm.

Crop image delivery

The images are broadly divided into early crop and harvest planning. Early crop views are captured at 6 to 8 weeks after sowing to view establishment and potential post-emergent broadleaf weed infestations. Two further images up to booting add crop growth progress information to your decisions about urea topdressing. The next one or two images look for events that affect harvest planning, such as pest and disease outbreaks (especially in pulse crops and canola), the extent of frost damage to cereals, and estimates of crop yields.

The science behind a vegetation index

The spectral vegetation index (VI) is a measure of the total green biomass at any given time. The canopy reflectance deduced from the red spectral region decreases due to increased chlorophyll absorption. By contrast, reflectance deduced from near-infrared spectra increases owing to an increase in spongy mesophyll structures in crop leaves as the crop matures. The VIs indicate crop growth and are related to plant biomass and grain yields. The peak value of the NDVI profile is analogous to the maximum leaf area index (LAI). The area under the curves is analogous to the total photosynthesis for the entire crop, and the average slope in the post-heading period is analogous to the rate of senescence.

More information

The CropView service is being developed to provide services to individual farmers, companies in closed-loop marketing of plant breeders rights varieties, grain accumulators, and marketers. Packages start at $1.95/ha ($0.78/acre) for three images. More information on CropView is available on the RMIT University Department of Geospatial Science website (www.gs.rmit.edu.au).