Determining pasture fertilizer requirements by satellite

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Fertilizers often represent more than 10 percent of production costs in grazing enterprises. Hence we have been investigating ways of using multispectral data (green, red and infrared) from earth resources satellites such as Landsat and SPOT to find which areas of improved pastures are most in need of fertilization with superphosphate. By relating the satellite data for the reflectance characteristics of pastures to known histories of fertilizer treatment it has been possible to calibrate the satellite measurements and then use them to predict and map the likely responsiveness of improved pastures (1). The research has involved the establishment of a data-base of showing soil and geological information, as well as data on roads, railways and regulatory boundaries such as pasture protection boards. The soil and geological data are used as masks, so that only satellite measurements from one soil type or geological parent material are analysed at any one time. The road and boundary data are used as an overlay to augment the map for field testing, thus allowing easy location of particular areas with a given fertilizer responsiveness.

Eventually it should be possible for agricultural extension officers, who have had training in satellite image interpretation, to be provided with colour coded fertilizer status images of their district. These images would enable the officer to advise farmers as to which parts of their property would be most responsive to superphosphate. The technology will also tell farmers and advisers where to soil test and show which areas do not need investigation, thus improving the efficiency of soil testing and fertilizer use on improved pastures.

Thus far, historical validation of the fertilizer maps has been done with 1975 Landsat data (2) and validation of products from 1985 and 1986 data is at present in progress. Fertilizer maps showing five fertility levels for the Armidale NSW region have been produced to show native and natural pastures coded green, partly fertilized pastures (ranging from 625 to 2250 kg/ha superphosphate) coded dark green, yellow and orange, and fully fertilized coded red (> 2375 kg/ha superphosphate); the forests are coded shades of blue. The maps have been rectified to The Australian Map Grid with the digitized roads as an overlay in black.

Other research using data from ground and aircraft based radiometers has been undertaken to determine the most suitable season for spectral differentiation of pastures with various fertility states (3). This work is directed to producing a spectral reflectance model for the fertility response, and will be used to refine the classification system for producing fertilizer maps from Landsat data.

1. Vickery, P.J., Hedges, D.S. and Duggin, M.J. 1980. Remote Sens. of Environment, 9 131-148.

2. Vickery, P.J. 1984. National Conf. Computers in Agriculture, University of WA. pp. 90-92.

3. Vickery, P.J. 1984. Proc. Aust. Soc. Anim. Prod., 14 131-133.