Range evaluation using aerial photography

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Erratum
Cover photo missing
RANGE EVALUATION USING AERIAL PHOTOGRAPHY

The cover photograph shows how vegetation and other parts of the environment, such as the soil and its mantle of pebbles, can appear differently on various types of film.

These images, which in jargon are known as “biological spectral signatures” are often so clearly typical of a particular species of plant or of certain soil conditions that it is possible to identify most plants and some soil conditions from aerial or ground photographs.

The upper triangle shows how the silver mulga in the centre and the fine scrubby mulgas to the left have strikingly different appearances on a film type called colour-infra-red. The lower triangle was taken with ordinary colour film.

If groups of aerial photographs from separate sites scattered over the country are gathered over a period of years it is possible, quickly and easily, to measure the vegetation changes which are taking place. Written records of ground measurements are costly to obtain and are rarely sufficiently accurate to be useful after 10 or 20 years, because the different operators employed over this period would have approached the measurement problem differently.

Range management

Pastoral land leased to sheep and cattle producers in Western Australia totals 238 million acres, virtually all of it in regions where annual rainfall is low and unreliable. Except for parts of the North Kimberley, which have fairly reliable rainfall, the productivity of the range pastures is controlled by the aridity of the environment.

Forage growth can be abundant in good seasons, but is sparse in dry years when most range plants are adapted to survive with no obvious growth. Besides this balance between plants and climate there is a balance between the plants themselves which has developed over many years. They compete for growing space and stored soil moisture until the number of various perennial plants of various ages remains relatively constant. Annual or ephemeral species appear in abundance only in good seasons.

By D. G. Wilcox*

The Department of Agriculture, in association with the University of Western Australia, recently undertook a study of the application of aerial photography to range condition monitoring in three rangeland types in the mulga zone of Western Australia.

The project was financed by the Rural Credits Development Fund and the C.S.I.R.O. Rangelands Research Unit.

This article deals in a general way with the possible use of aerial photography in rangeland administration.

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A well managed bluebush pasture (left) and an overused bluebush pasture (right). Differences less obvious than this can be easily detected using remote sensing techniques.

The delicate balance between the range plants and their natural environment can be easily upset by grazing animals. A moderate and continuous stocking level may be acceptable in good seasons but the same level can seriously impede recovery of the pasture after periods of severe stress, such as drought, when plants are making efforts to survive. Excessive grazing at this time will kill many of the plants, particularly those which are readily eaten by animals.

Range management is the skilled task of using the forage available without reducing the abundance or productivity of the useful plants.

Aerial photography in range management

In a field application of aerial photography, or "remote sensing", to monitor range condition, study sites would be established at appropriate places on properties or on areas of interest. They would have to be clearly identified by ground markers to help later photo missions. Each site would initially be thoroughly measured by ground parties and the information, or "ground truth", correlated with the first set of photographs to provide the base for the monitoring programme. A collection of photos of one site built up over a number of years would enable the range manager to detect trends in range condition and change stocking policy accordingly.

Species identification

The colour signature on colour-infra-red film together with characteristics such as shadow type and length can be expected to give reliable species identification and this in itself can show trends in range condition. For example a decrease in numbers of broad leaved wandarrie and an increase in wind grass can be easily detected, and will indicate deterioration of the pasture. Shifts away from perennial saltbushes and bluebushes towards annual species can also be detected and indicate degradation.

Soil conditions

In many rangeland types, particularly the saltbush-bluebush types, the changes take place over lengthy periods. Changes in soil surface conditions often precede the collapse and the resurgence of the useful perennials. Photographs taken at appropriate heights can detect these soil changes.

Plant cover

The total cover of plants is often a reliable guide to the health of the range, and can be directly measured from aerial photographs. With accurate species identification, the technique is quicker, easier and more accurate than the same measurements made on the ground.

Sheep tracks

Recent work in Australia has shown that the density of animal tracks can be a measure of pasture use. Tracks show out very clearly on low level photographs and particularly well on colour-infra-red photographs. Aerial missions could easily, cheaply and efficiently detect the changes in stock numbers reflected by the density of animal tracks.
Other uses

Agricultural aspects such as plant disease and soil salinity can be mapped by aerial photography. Disease in green growing crops can be detected with colour-infra-red film before it is evident to the naked eye.

Prints obtained using infra-red or multi-spectral film are used in mineral prospecting. In some cases there are close associations between zones of special minerals and the plant species supported by the soil above the mineral zone. Identification of these zones through the plant species is feasible over very large and inaccessible areas using aerial photography.

Some minerals, particularly basic and ultrabasic types, have a specific response to colour infra-red film, producing a definite blue tinge on the prints, which allows them to be positively identified without intensive ground searches.

Remote sensing by satellite

Satellites equipped to scan areas 100 miles wide will be part of an earth resources survey by the U.S. National Aeronautics and Space Administration in the next few years. Individual features smaller than 700 feet in width and length will not be detectable and the photographs obtained will mainly show broad terrain features such as the type and structure of rocks, the depth of soil, the depth of water table, old river systems and other geographical aspects which may not be obvious to the naked eye. When related to ground information, types of range and forest vegetation could be mapped from the satellite photographs.

NORTHERN ADVISORY SERVICES

With the intensification of activities in both agriculture and other sectors in the North and North West, the Department’s advisory services to these areas have been re-arranged to strengthen the contribution by specialist Divisions. The North West Division has been abolished and its responsibilities allotted to two other Divisions as follows:

1. The pastoral activities will be handled by the same personnel forming a new Rangelands Management Section within the Soils Division. The Rangelands Section will have officers stationed at Kununurra, Derby, Port Hedland, Carnarvon, Wiluna and Kalgoorlie, and will control the Ord Catchment Regeneration Project, and research stations at Fitzroy, Abydos and Wiluna.

2. Irrigated farming activities, both irrigation and crop management, will be the responsibility of the Irrigation Section of the Soils Division, with officers in the North based at Kununurra.

3. Horticultural aspects, such as the Carnarvon plantation area, including the Gascoyne Research Station, will be handled by the Horticulture Division.