Farmnote

Airborne geophysics - a tool for salinity control

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Salinity series

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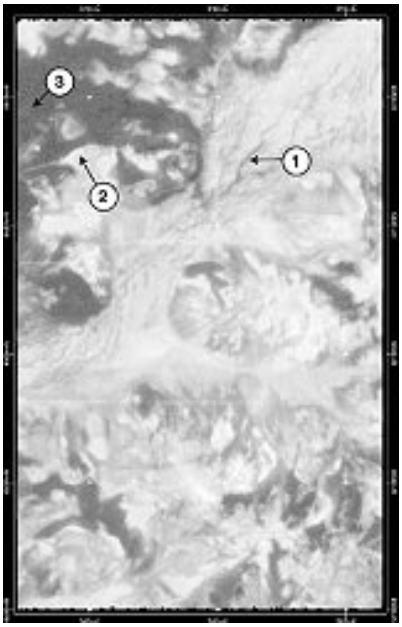
Airborne geophysics has been used as the primary method of mineral exploration in Western Australia since the 1950s. Magnetics and radiometrics are used in most surveys and since the 1980s electromagnetic systems have also been developed. Application of these datasets for land management began in the mid-1980s, although significant analysis and interpretation has been undertaken for farm and catchment planning only in the last five years.

Three principal datasets are collected by low flying aircraft (fixed wing or helicopters):

- **Magnetics** reveals the magnetic susceptibility of the basement rock. This accurately locates the position of dykes, shear zones and faults which enables more accurate prediction of future outbreaks of salinity. It also helps to explain the current distribution of salinity. Useful information can also be supplied on effects of subsurface features on the siting of bores and dams.
- **Radiometrics** determines the level of the radioactive elements, uranium, potassium and thorium and the total radioactivity in the upper 50 cm of the soil profile. Interpretation of this data is becoming an important new tool in soil surveys.
- **Electromagnetics (AEM)** measures the salt store in the regolith (weathered or sedimentary material that is over the bedrock). In some environments AEM systems can be used to assess groundwater salinity and it may be possible to estimate the depth to bedrock. To date, it has not been possible to accurately measure salt stored in the upper 5 m of the soil profile from the air although this can be achieved using ground-based systems.



1. *'Potassium-rich' braided stream*
2. *'Thorium-rich sandy gravels'*
3. *'Sandy uperslope sandplain'*

This example of airborne radiometrics shows a 9000 ha area at paddock scale near Wyalkatchem flown in March 2001. Such maps reveal the location of leaky soils, the most fertile land and other factors which can be used to aid placement of engineering structures. They have potential use also for variable rate technology with fertilser and herbicide application.

Cost

The cost of airborne geophysics will depend on the type of aircraft used and the line spacing flown. In Western Australia, land management surveys are typically undertaken at a 150 m line spacing, although in some areas a spacing of less than 100 m is required.

At present, base prices for the collection and processing of high resolution magnetic and radiometric data are about $6 per line kilometre ($0.6/ha at 100 m spacing). Wider line spacing reduces the cost of collection but also the accuracy of data. Depending on the contract, the base price may include interpretation at a scale between 1:100,000 and 1:50,000 (catchment scale). To be useful for land management, most data must be interpreted at a scale of 1:25,000 or less (farm and paddock scale).

Electromagnetic data costs about $5/ha for relatively large fixed wing systems and more than $10/ha for some helicopter-mounted systems. This price usually includes magnetic and radiometric information, and may also include processing and some interpretation. Full interpretation is likely to cost an additional $1 to $3/ha on top of collection.

Existing geophysical data

Low-resolution data exists for the entire agricultural region, although most has been collected at a line spacing of 1.5 km and at an elevation of 400 m, making it if marginal value for any catchment investigation.

The Geological Survey of Western Australia keeps a record of all detailed geophysical surveys conducted in WA and has databases called MAGIC and MAGCAT (see www.dme.wa gov.au), which house this information. Check with the Geological Survey to learn whether your area has been flown.

Benefits from airborne geophysics

Professionally-interpreted airborne geophysics can assist land management by:

- improving the diagnosis and prognosis of the problem leading to more economic solutions;
- allowing more accurate preparation of farm-scale salinity prediction maps;
- allowing farmers to understand why salinity has occurred at particular sites;
- allowing for more effective placement of treatments (e.g. groundwater bores, trees and crops);
- providing soils maps at a paddock scale for use by all areas of the agricultural industry.

Airborne geophysics can also aid regional development by providing:

- opportunities for economic growth through exploration and mineral extraction; and
- high-resolution data that can be used to more accurately assess resources and opportunity for new industries (such as areas of deep sands for the maritime pine industry).

A careful analysis of the benefits and costs of acquisition is recommended before any large scale survey is planned.

Further reading

- 'Geophysics the focus of joint studies', in *Primary Focus*, Winter edition No 1, 1998.
- Evaluation of airborne geophysics for catchment management, National report, 81 pp by RJ George, R Beasley, I Gordon, D Heislers, R Speed, R Brodie, C McConnell, and P Woodgate. (1999). See www.ndsp.gov.au/
- Geological Survey of WA see www.dme.wa gov.au

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